ELECTRICAL REVIEW

FRIDAY
6 JANUARY 1961

WEEKLY
PRICE 1s 6d

AEI SWITCHGEAR in SCOTLAND



Photograph by courtesy of South of Scotland Electricity Board. Consultants: Messrs. Kennedy & Donkin.

This twelve-switch, outdoor switching station at Neilston, Renfrewshire (South of Scotland Electricity Board) is equipped with air-blast circuit-breakers of the type GA6W4, with a rating of 132 kV—3500 MVA, manufactured by AEI. Two further circuit-breakers of the same type are to be added. These will control the 132 kV side of the two 'Supergrid' transformers which will be installed in the adjacent 275 kV Sub-station. In addition, outdoor current-transformers and extensions for the existing control and relay boards will be supplied. The generating station at Kincardine-on-Forth is similarly equipped with AEI switchgear, to the order of the South of Scotland Electricity Board. These installations will link up with the projected 275 kV scheme in South Scotland.

For further details, write to AEI Switchgear Division, Trafford Park, Manchester, 17 or to your local AEI Office.

AEI **Associated Electrical Industries Ltd.**
Switchgear Division
TRAFFORD PARK, MANCHESTER · HIGHER OPENSHAW, MANCHESTER · WILLESDEN, LONDON

F/A 013

Ever increasing power demands

PIRELLI-GENERAL

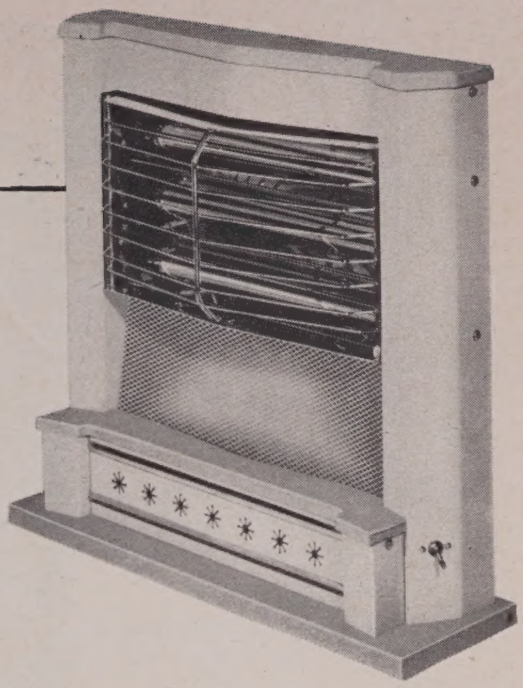
oil-filled cables



PIRELLI-GENERAL CABLE WORKS LTD., SOUTHAMPTON.

Heatrae

THE FIRES THAT ARE BORN OF EXPERIENCE





THE "BALLERINA" 2kW

A brilliant combination of contemporary styling and Heatrae workmanship, the "Ballerina" is both extemely attractive and highly efficient. It is designed primarily as a free-standing unit.

THE "MAJESTIC" 2kW

Equally appropriate in traditional or contemporary surroundings, the Majestic is essentially a hearth fire. Cleverly diffused illumination provides a cheerful glow and adds to the look of comfort.

Both of these fires incorporate the latest embedded rod heating elements. The load is disposed on three 666 watt elements and is controlled by a unique 3 HEAT SWITCH ARRANGEMENT for one, two or three elements. The extra long elements give a very wide spread of heat.

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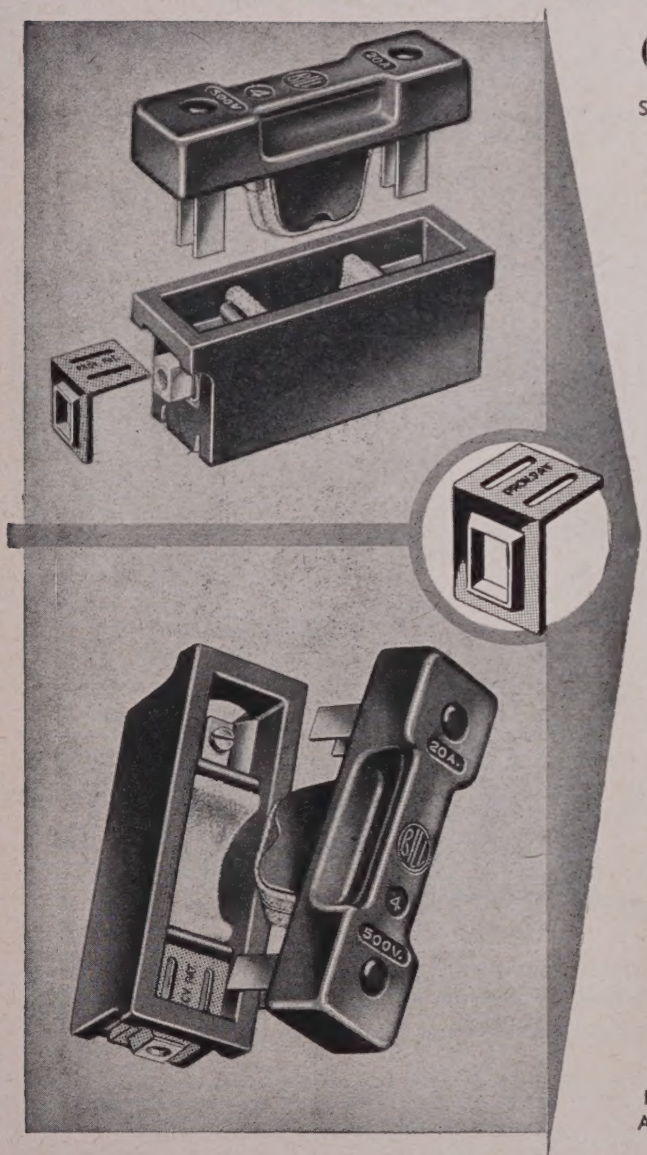


Why look elsewhere, when all the benefits of long specialization plus the closest adherence to exacting quality standards are so conveniently available. Let ORMOND quote for all Repetition Parts—for single and multi spindle automatics up to $1\frac{1}{4}$" diameter; Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grub screws, Nuts, Allthreads, Hexagon Bolts and Set screws turned from bar and Cold Headed Grades "A", "B" and High Tensile.

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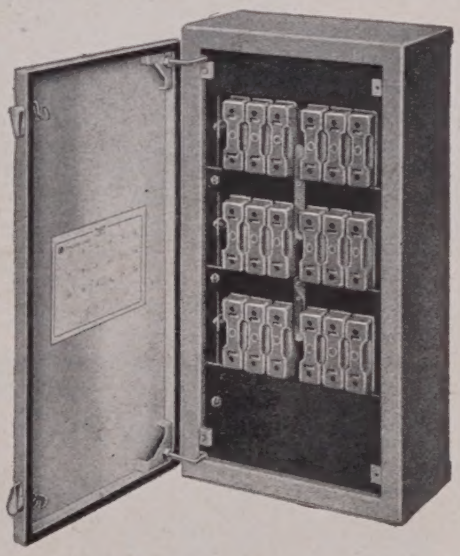
You cannot buy better gear

SAFETY BILL SHIELDS



BILL ARC DAMPING TYPE OR H.R.C. DISTRIBUTION FUSEBOARDS ARE NOW FITTED WITH THE BILL SAFETY SHIELDS (PROV. PAT.) AS ILLUSTRATED.

FUSEBOARDS ARE AVAILABLE WITH NO PRICE INCREASE IN ALL SIZES OF 15/20 AMP. AND 30 AMP. RATINGS.



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BILL SWITCHGEAR LTD

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DORMAN

DISTRIBUTION FUSE BOARDS

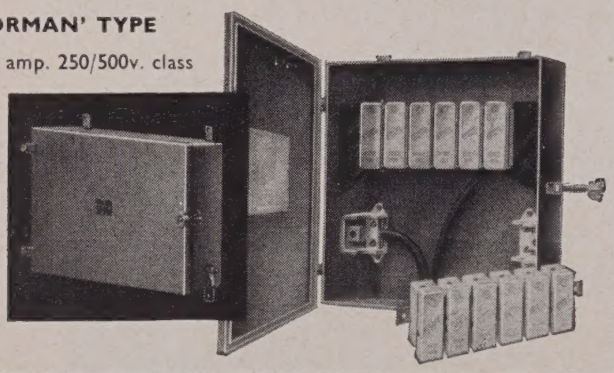
We manufacture two patterns of Distribution Fuse Boards — 'Industrial' and 'Flowline' for 0/100 amps. 250/500v. S.P. & N. D.P. T.P. and T.P. & N.

The standard finish is 'hammered' grey enamel. Where special protection is required boards can either be galvanised or treated with a special zinc spray finish.

INDUSTRIAL PATTERN

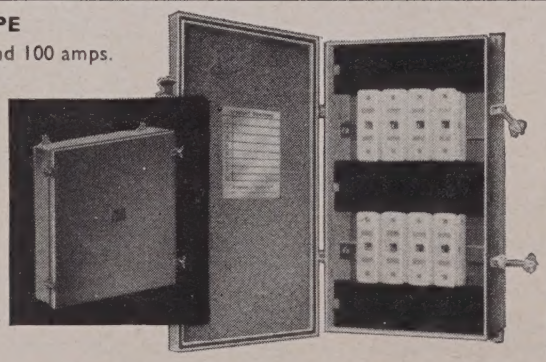
'DORMAN' TYPE

0-30 amp. 250/500v. class



'ASC' TYPE

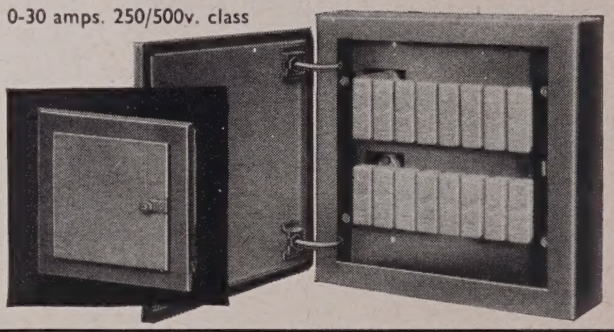
15/30, 60 and 100 amps. 500v. class

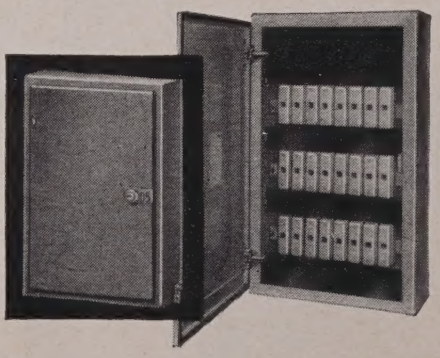


FLOWLINE PATTERN

'DORMAN' TYPE

0-30 amps. 250/500v. class





'ASC' TYPE

15/30, 60 and 100 amps. 500v. class

Both 'Industrial' and 'Flowline' pattern boards can accommodate from 4 to 12 ways and are supplied up to 100 amp. rating for S.P. & N., D.P. T.P. and T.P. & N. circuits. Our range of Distribution Fuse Boards is of compact design, reasonably priced, and has many distinctive features. Fully illustrated catalogue available on request.

DORMAN & SMITH LTD.

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Tel.: Preston 86785 (6 lines)

LONDON 125 High Holborn, W.C.1
Tel.: CHAncery 6431

BIRMINGHAM 2/3 Graham Street, Birmingham 1
Tel.: CENtral 2009

GLASGOW 73 Robertson Street, Glasgow, C.2.
Tel: CENtral 2479

To DORMAN & SMITH LTD.,
Preston, Lancashire.

Please send latest Dorman Distribution Fuse Board Catalogue.

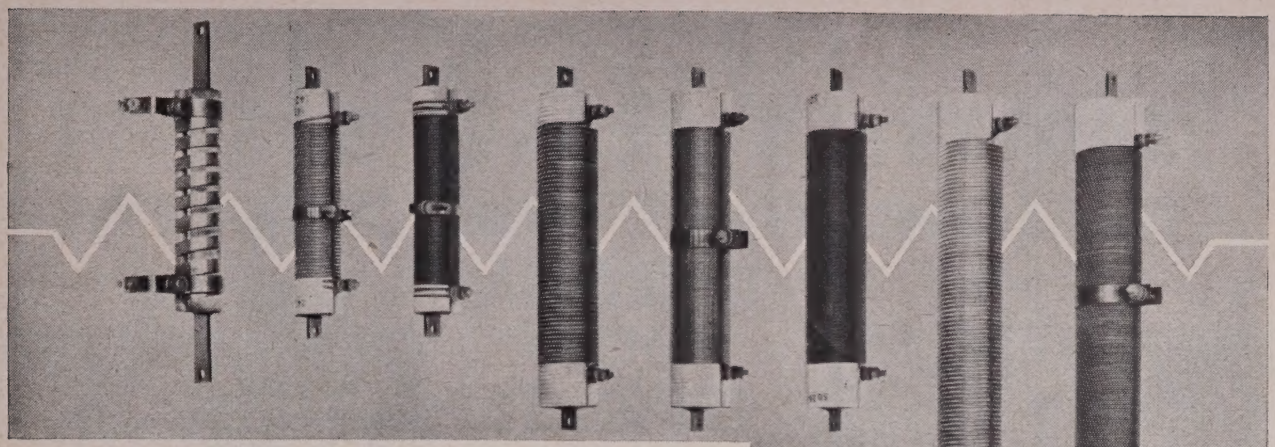
NAME .....

POSITION .....

FIRM .....

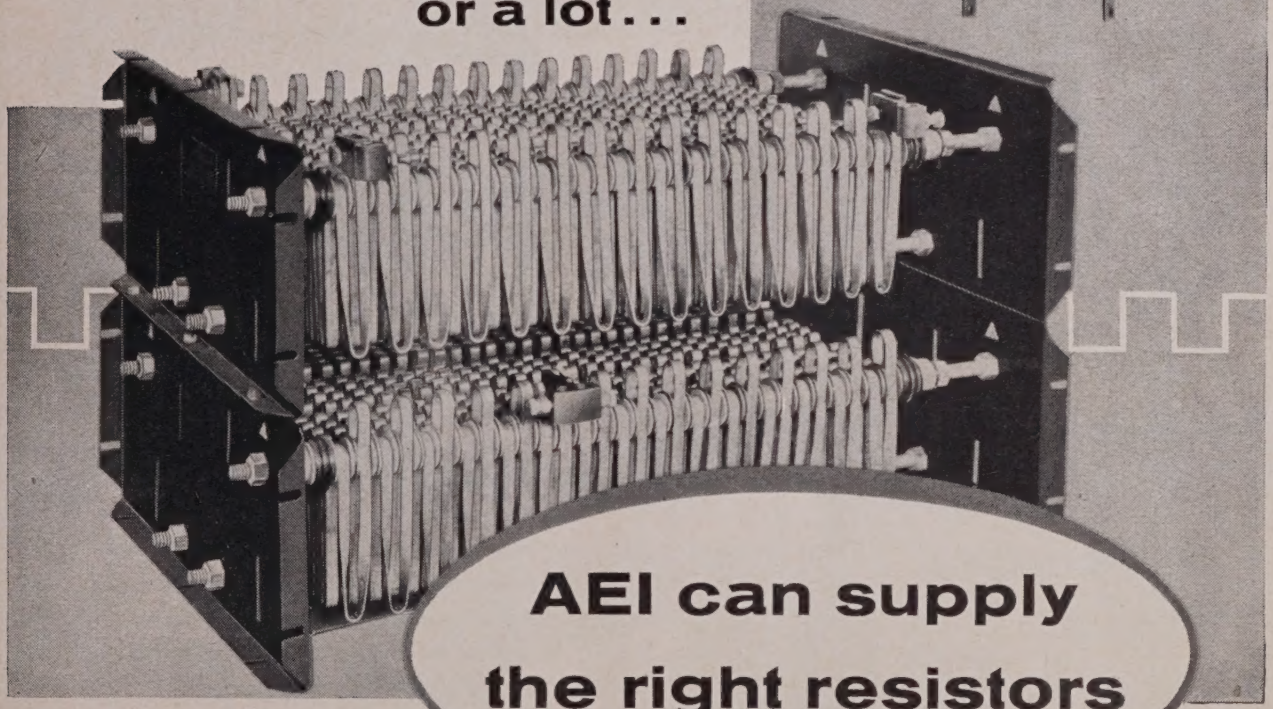
ADDRESS .....

ER/6/1/61



Whether you need a little

or a lot...



AEI can supply the right resistors

Whether you require a resistor with a rating of a few watts or the most rugged heavy-duty unit, AEI can supply the right resistor for the job. Their range includes general service, severe duty and extra-heavy-current types.

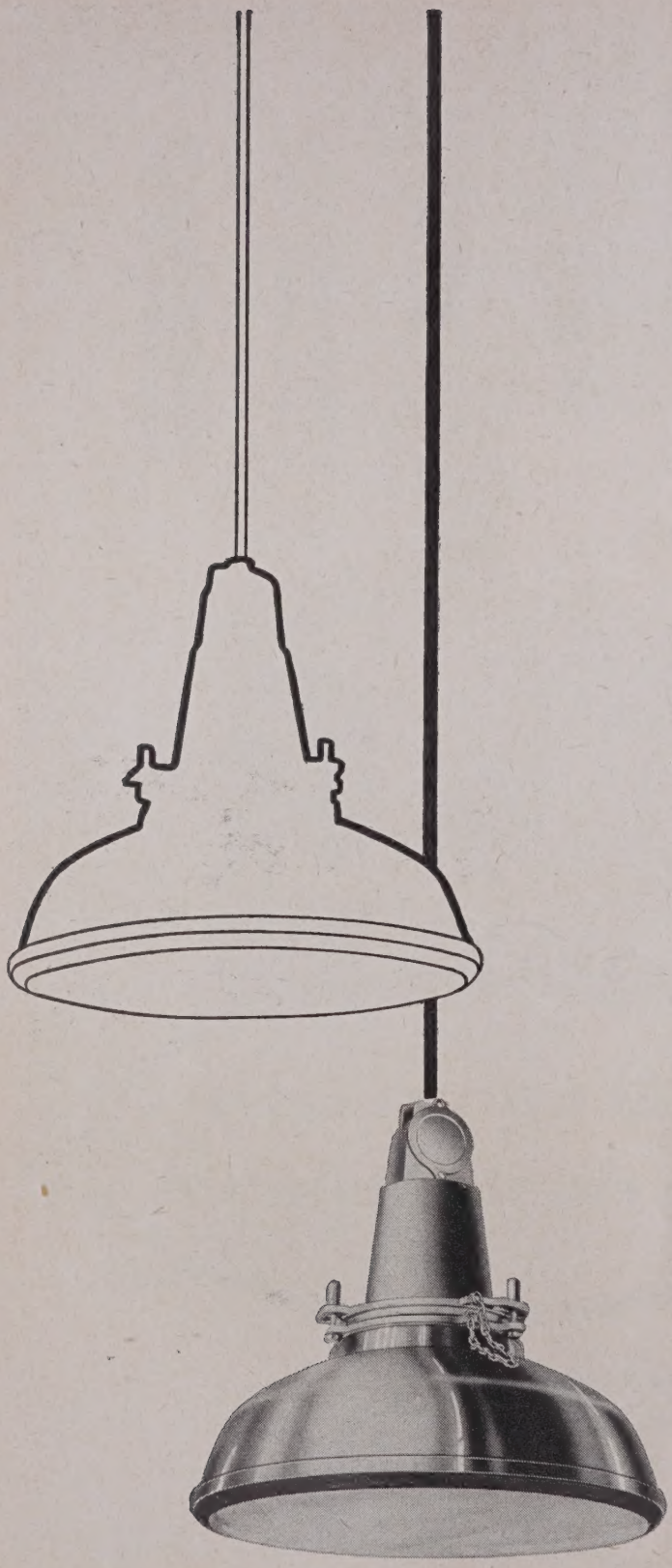
Write for further information and technical data to:

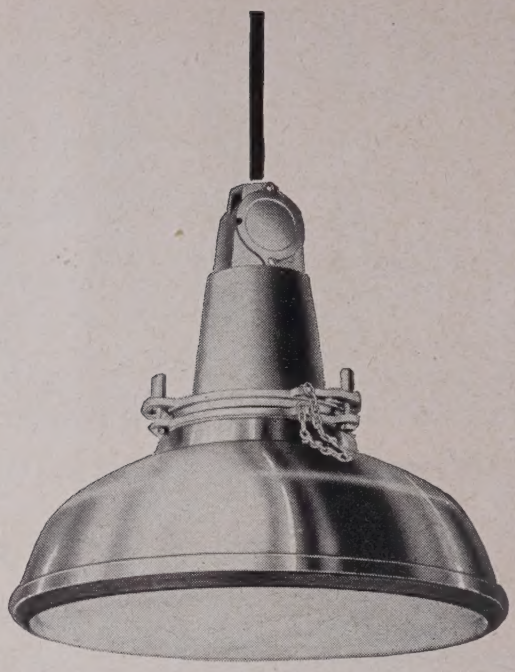
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Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY AND MANCHESTER, ENGLAND

B·T·H *INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V*

A5489





New

DUST PROOF THOROSEAL LIGHTING UNITS

make it easy to keep your lights clean. Hose the grime off without fear of water penetration. Smooth surfaces and sealed in toughened glass exclude all dust, vapours and fumes.

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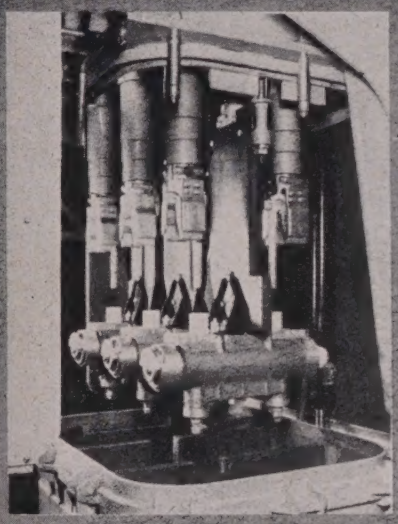
HI-VE 18 33kV OUTDOOR METALCLAD SWITCHGEAR

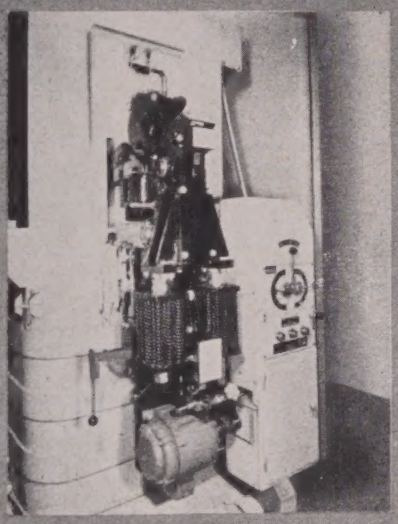
OUTSTANDING HIGH-PERFORMANCE
1,000 MVA O.C.B.

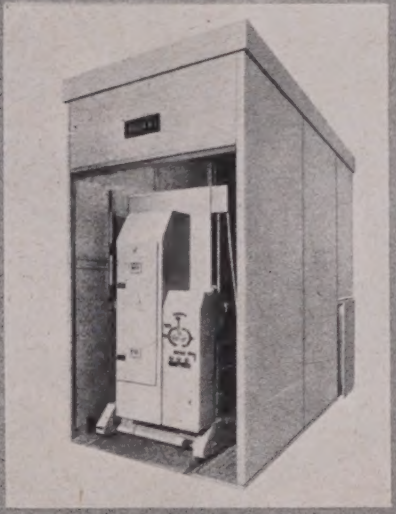
ADVANCED DESIGN FEATURES

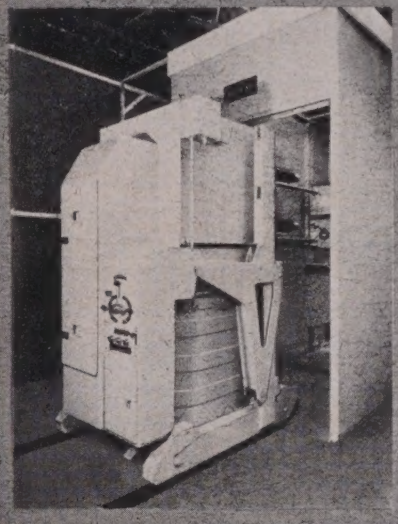
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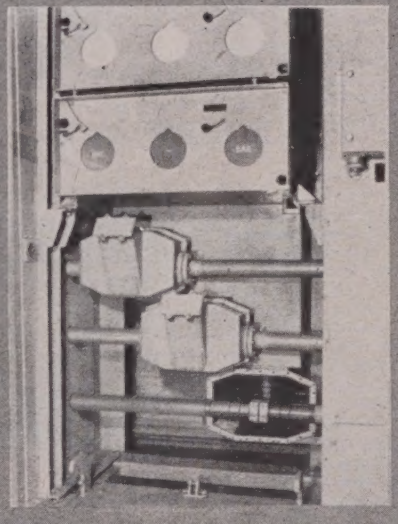
HYDRAULICALLY ACTUATED O.C.B.
CLOSING MECHANISM.

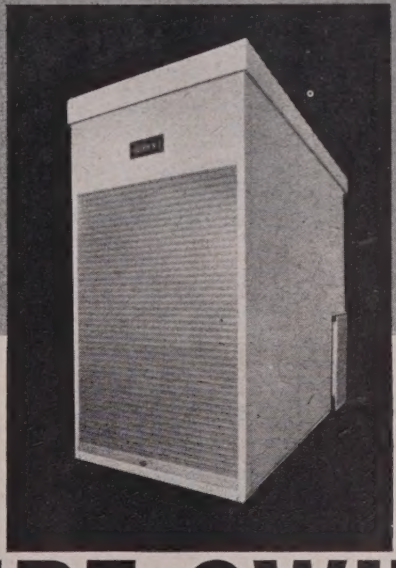












O.C.B. /C.T. CHAMBER MOVING PORTION
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CONDENSER TYPE BUSBARS WITH
TEE-OFF JUNCTION BOXES.

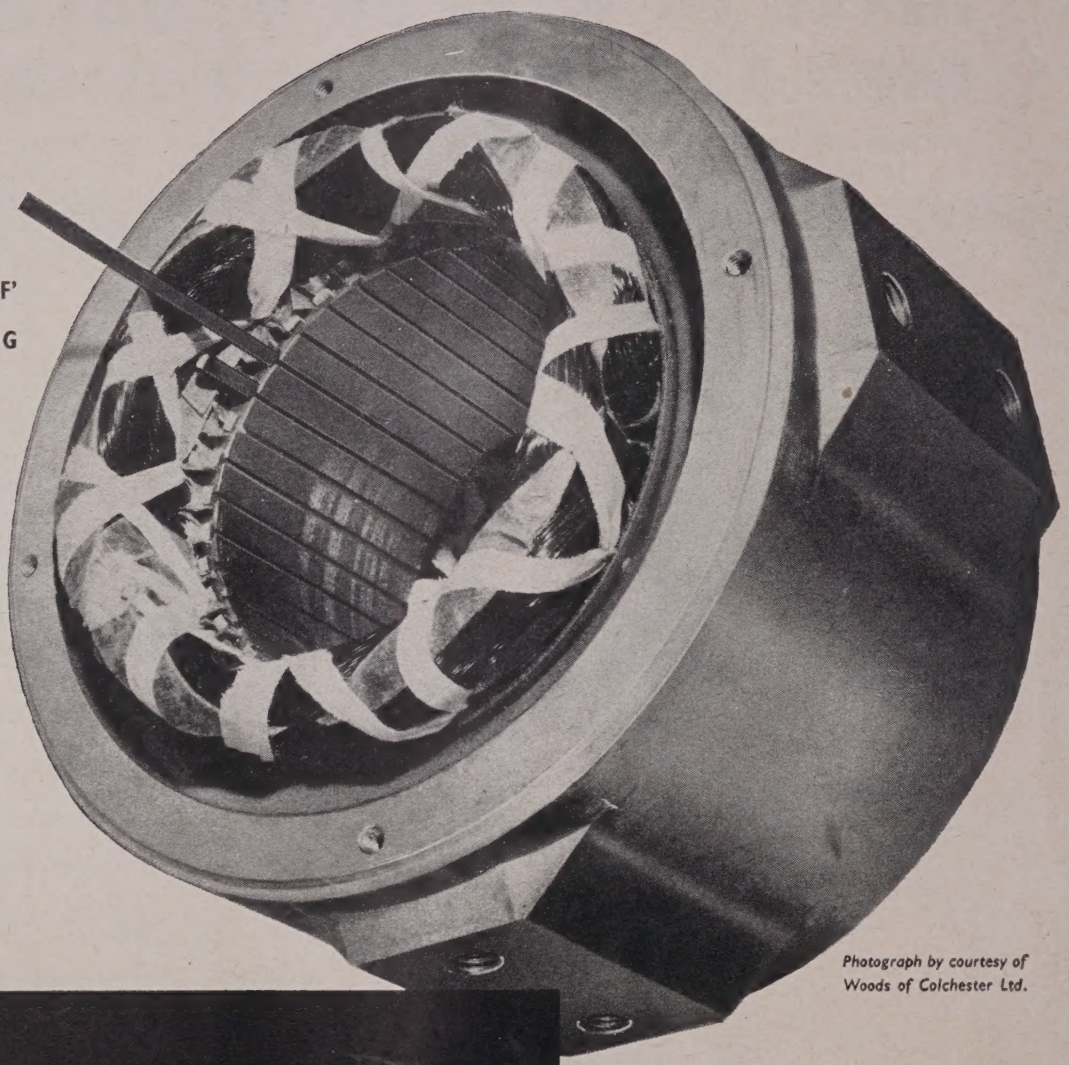
A COMPACT SELF CONTAINED WEATHERPROOF
UNIT ON 5′ 9″ CENTRES.

YORKSHIRE SWITCHGEAR & ENGINEERING CO. LTD.

MEANWOOD, LEEDS 6, ENGLAND TEL. 57121/5

HIGH TEMPERATURE ELECTRICAL INSULATION

SLOT WEDGES
FOR CLASS 'B' & CLASS 'F'
TEMPERATURE RATING



Photograph by courtesy of Woods of Colchester Ltd.

"SILUMINITE"
REGD. TRADE MARK

SYNTHETIC RESIN BONDED

ASBESTOS LAMINATES

The illustration shows "SILUMINITE" Synthetic Resin Bonded Asbestos Paper Laminate, Symbol No. ELS. 8, used for the stator slot wedges of a two-stage Aerofoil Fan. The motor is rated for a maximum temperature of 160° C.

"SILUMINITE" Asbestos paper, Asbestos Fabric, and Asbestos Felt Laminates are being used more and more for slot wedges on all sizes of machines. These asbestos based electrical insulations, with virtually indestructible inorganic fillers, have excellent mechanical properties coupled with *thermal and dimensional stability at high operating temperatures.*

A quality product

TURNERS ASBESTOS CEMENT CO LTD

A MEMBER OF THE **TURNER & NEWALL** ORGANISATION

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Press button way to FUEL ECONOMY



The Venner WAITING ROOM TIMER removes the need to remember. Designed primarily to provide measured heating in unattended waiting rooms, this simple, robust timer has many applications. When the button is pressed, the main circuit is switched on for a predetermined time. At the end of the time, the current is switched off automatically and remains off until the button is pressed again.

The WAITING ROOM TIMER is fully enclosed in a robust cast aluminium case, with lugs for wall mounting and provision for conduit entry.
Rating, 15 amps. 200/250v A.C.

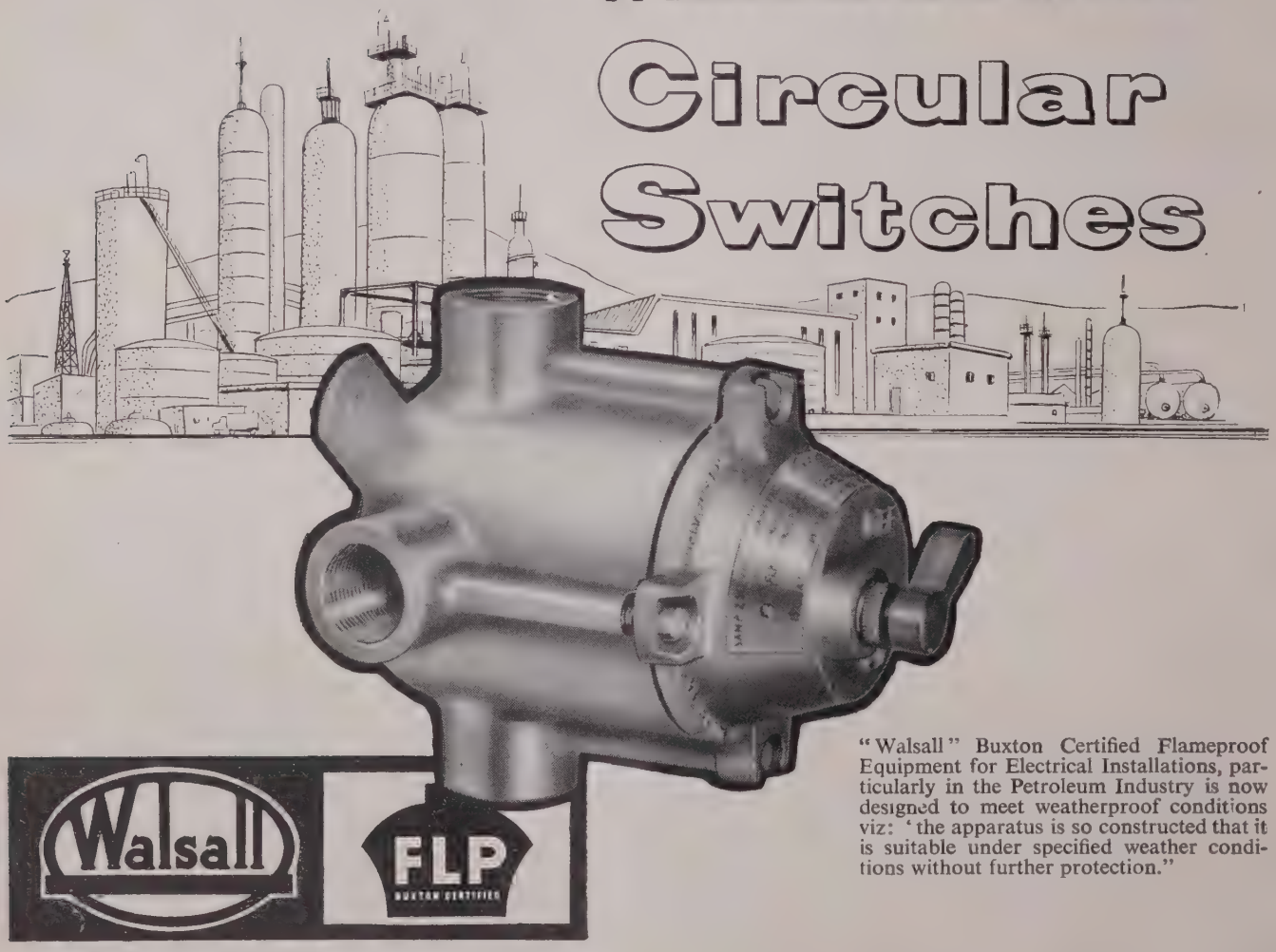
Send for leaflet P/1.

VENNER Time Switches

VENNER LIMITED,
Kingston By-pass, New Malden, Surrey. MALden 2442.

FLAMEPROOF + AND NOW WEATHERPROOF

Circular Switches



"Walsall" Buxton Certified Flameproof Equipment for Electrical Installations, particularly in the Petroleum Industry is now designed to meet weatherproof conditions viz: 'the apparatus is so constructed that it is suitable under specified weather conditions without further protection."

FLAMEPROOF/WEATHERPROOF CIRCULAR SWITCHES

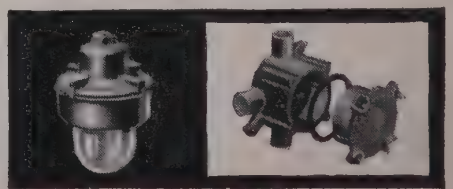
BUXTON CERTIFIED Groups I, II, & IIIa & IIIb.
5 AMP 250 VOLTS—Single or Double Pole.

The unit consists of a heavy cast iron case having a machined spigot joint with cover, between which is a "Neoprene" packing washer, the whole providing a Flameproof and Weatherproof joint. The cover is secured by 4 shrouded head bolts to prevent unauthorised removal. The switch movement is mounted on a patented insulating plug, which *is easily* removable for quick wiring.

FURTHER FLAMEPROOF/WEATHERPROOF UNITS AVAILABLE

WELL GLASS LIGHTING FITTINGS
40, 60 or 100 Watt
BUXTON CERTIFIED Groups II & III

CONDUIT JUNCTION BOXES
BUXTON CERTIFIED Groups II, IIIa & IIIb

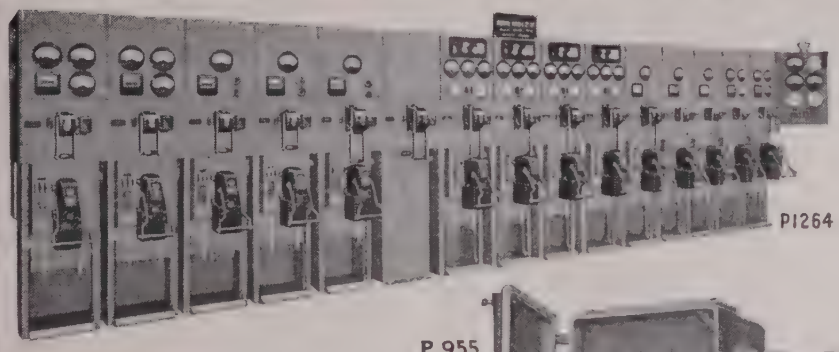


WALSALL CONDUITS LIMITED

EXCELSIOR WORKS · WEST BROMWICH

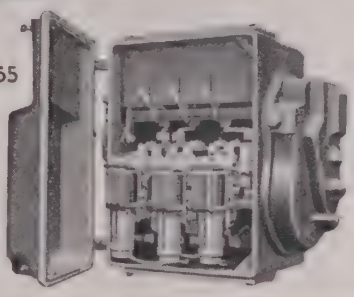
WE ARE SPECIALISTS IN SWITCHGEAR & MOTOR CONTROL GEAR

SWITCHBOARDS & HAND-OPERATED MOTOR CONTROL GEAR



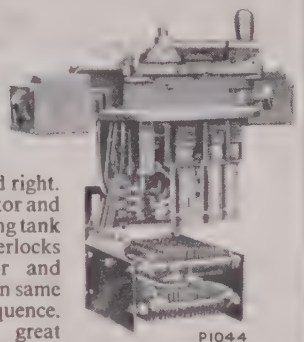
P1264

P1264 Illustrated left, Switchboard recently supplied for controlling diesel Alternator Sets and Feeders at a large Sewage Works. This Switchboard is of the duplicate busbar type and contains circuit breakers ASTA certified at 25 MVA to BS. 116 at 400 volts.



P. 955

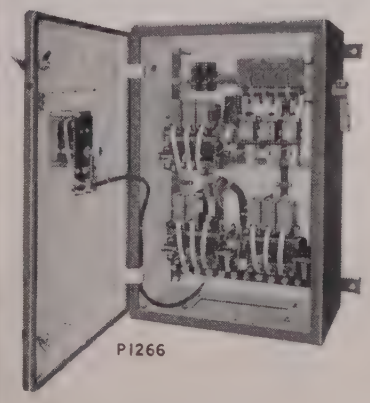
P 955 Illustration on the right is of a hand-operated air break star delta starter, fitted with interlocked isolator and solenoid type overloads with time lags. This starter can also be supplied as a direct-on starter.



P1044

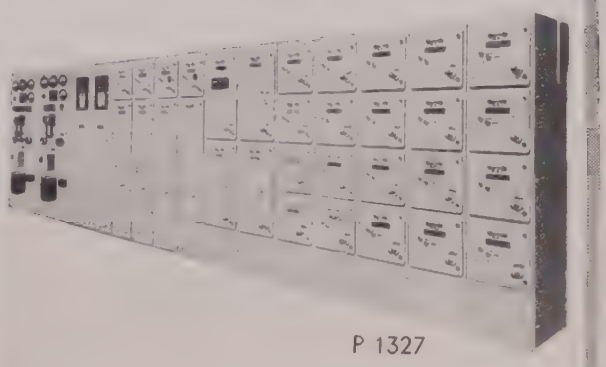
P1044 Illustrated right. Combined type stator and rotor starter showing tank removed. No interlocks required as stator and rotor contacts are on same drum in correct sequence. There is also a great saving in floor space.

CONTACTOR TYPE SWITCHGEAR & MOTOR CONTROL GEAR

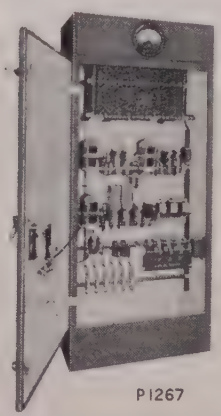


P1266

P1327 Illustrated right, multi motor contactor type Switchboard recently supplied for controlling air conditioning and refrigeration plant in the Middle East.



P 1327



P1267

P1266 Starter illustrated above is one of our CS. 30 pattern star delta starters, suitable for use up to 20 H.P. This type of starter is made in different ranges up to 250 H.P.

P1267 Starter illustrated at the left is a 50 H.P. CS. 75 type stator and rotor starter. This starter is made in different ranges up to 250 H.P. All our contactors above the CS. 15 size are bar mounted with powerful magnetic blowouts.

WE MANUFACTURE :- L.T. SWITCHGEAR 50/7,000 Amperes. E.H.T. SWITCHGEAR up to 11 kV. 250 MVA rupturing capacity. MOTOR CONTROL GEAR ¼/5000 H.P.

ERSKINE, HEAP & Co LTD

SWITCHGEAR SPECIALISTS

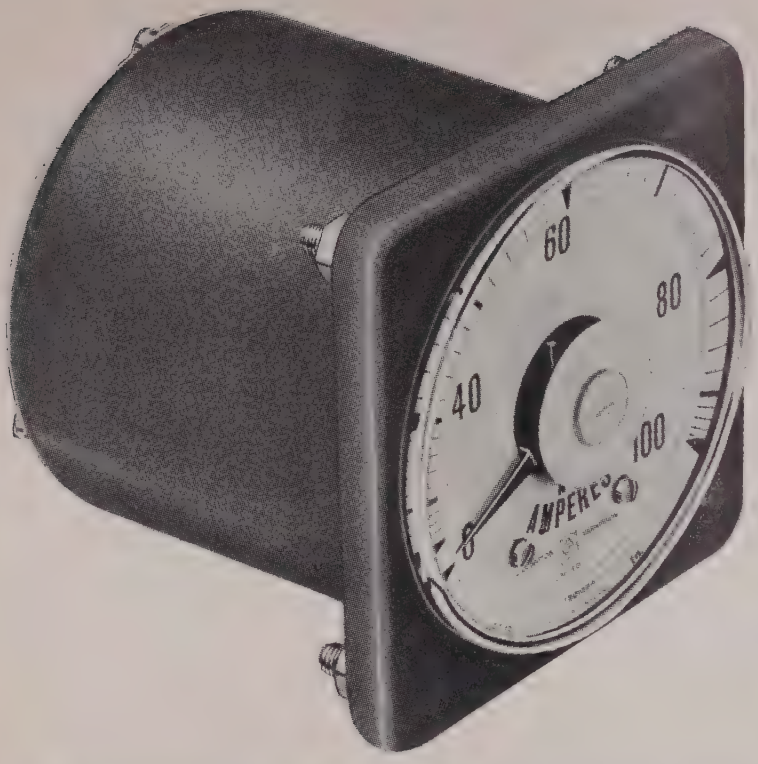
Head Office & Works
BROUGHTON, MANCHESTER (7)

London Office
GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

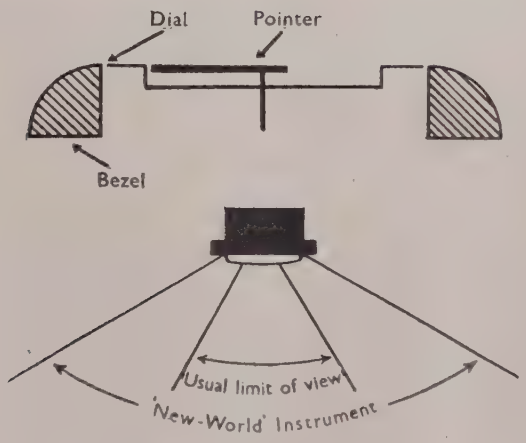
May we have your enquiries?

730



Crompton Parkinson instruments are known for accuracy, robustness, and their long and easily readable scales. All these expected features are present in the 'New-World' range, which includes ammeters, voltmeters, wattmeters, synchroscopes and speed, frequency, and power-factor indicators. But 'New-World' instruments have a number of special advantages of their own—the most important being their exceptional readability at oblique angles.

Spot on—even sideways



From well outside the usual angle of view, 'New-World' instruments give a clear and accurate reading. This is the result of three features of the dial: it is flush with the front of the bezel, and therefore better lit, completely shadow-free and readable from wider angles; the pointer is in the same plane as the scale markings, eliminating parallax; and a specially contoured glass cover completely prevents light striations across the dial. 'New-World' instruments have 240° circular scales $6\frac{1}{2}''$ long, and bezels $4\frac{5}{16}''$ square. (360° scales for power-factor indicators and synchroscopes).

Crompton Parkinson LIMITED

ELECTRICAL EQUIPMENT

Makers of Electric Motors of all kinds A.C. and D.C. Generators, Cables, Switchgear, B.E.T. Transformers, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans.

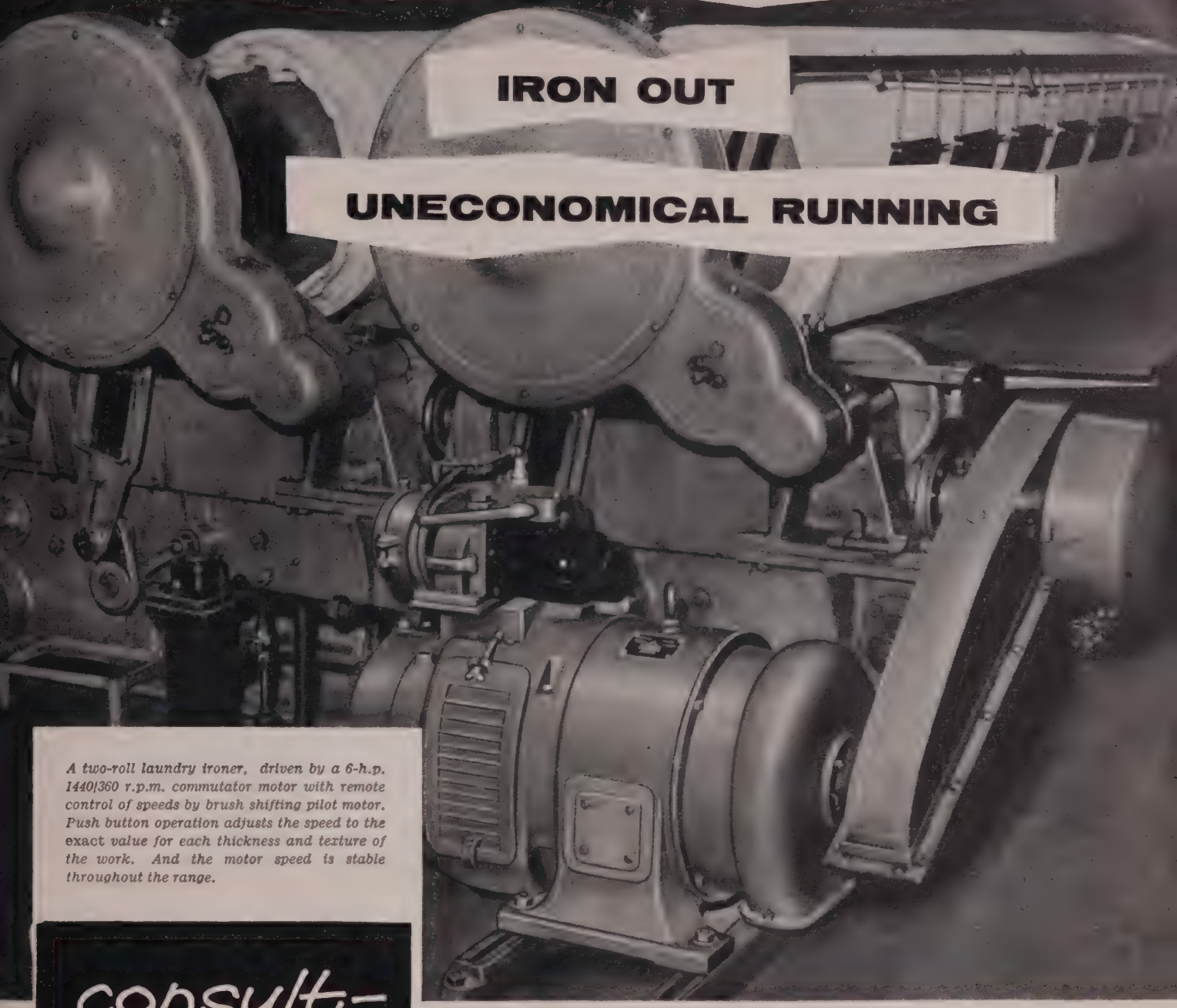
CROMPTON PARKINSON LTD · CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2

1611

Electrical Review
6 January 1961

FULLER COMMUTATOR MOTORS

IRON OUT UNECONOMICAL RUNNING



A two-roll laundry ironer, driven by a 6-h.p. 1440/360 r.p.m. commutator motor with remote control of speeds by brush shifting pilot motor. Push button operation adjusts the speed to the exact value for each thickness and texture of the work. And the motor speed is stable throughout the range.

consult-

FULLER ELECTRIC

A member of the Hawker Siddeley Group

Sole U.K. representatives for ASEA Sweden
FULLER ELECTRIC LIMITED
FULBOURNE ROAD · LONDON E.17
Telephone: LARkswood 2350

Also at Birmingham, Glasgow and Manchester

In this instance, a Fuller Variable Speed A.C. Commutator Motor enables this laundry ironer to provide the exact finish required without waste of time and current. But these motors can be applied to any industrial process.

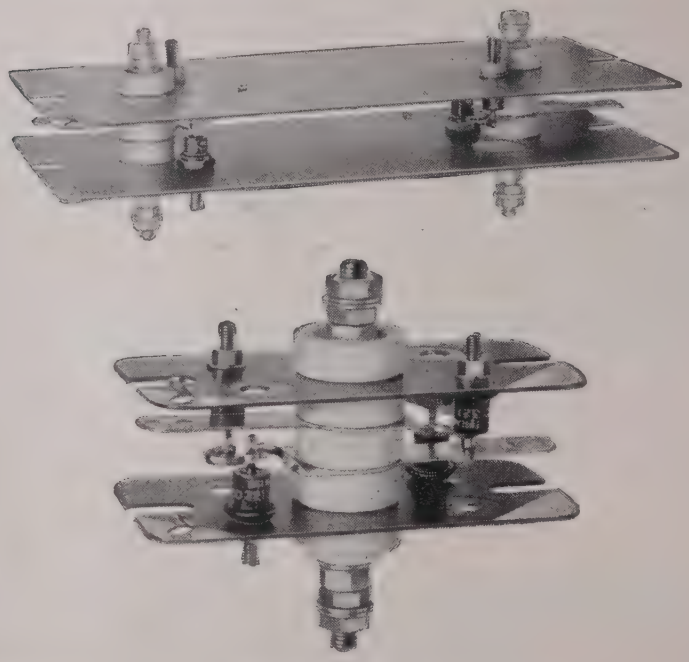
The INFINITE variable speed characteristic of the Fuller A.C. Commutator Motor means that your machine can be operated at precisely the exact speed to give maximum output of quality and quantity. The speed required is maintained irrespective of normal load variation. Commutator Motors require no resistance or external regulator; current consumption is reduced at lower speeds bringing savings in power costs.

We shall be glad to explain how your factory can benefit by using Fuller Commutator Motors.

BRADLEY
BRIDGE RECTIFIERS

INCORPORATING LUCAS SILICON DIODES

A new range of silicon rectifiers, suitable for single-phase full-wave bridge operation. Available in 2A, 7A, 12·5A and 20A stacks, each with peak inverse voltage ratings of 50, 100, 200 and 600 volts.



Model No.	Dimensions (inches)	P.I.V.	Max. input volts (R.M.S.)	IDC (amps) at 25°C	Max. ambient temp. °C
IB320A	1⅛×3×2⅜	50	35	2·0	150
IB321A	1⅛×3×2⅜	100	70	2·0	150
IB323A	1⅛×3×2⅜	200	140	2·0	150
IB326A	1⅛×3×2⅜	400	280	2·0	150
IB320B	3 ×6×2⅜	50	35	2·0	150
IB321B	3 ×6×2⅜	100	70	2·0	150
IB323B	3 ×6×2⅜	200	140	2·0	150
IB326B	3 ×6×2⅜	400	280	2·0	150
IB510A	1⅛×3×2⅜	50	35	10·0	100
IB511A	1⅛×3×2⅜	100	70	10·0	100
IB513A	1⅛×3×2⅜	200	140	10·0	100
IB516A	1⅛×3×2⅜	400	280	10·0	100
IB510B	3 ×6×2⅜	50	35	18·5	100
IB511B	3 ×6×2⅜	100	70	18·5	100
IB513B	3 ×6×2⅜	200	140	18·5	100
IB516B	3 ×6×2⅜	400	280	18·5	100
IB510C	4 ×8×2⅜	50	35	20·0	100
IB511C	4 ×8×2⅜	100	70	20·0	100
IB513C	4 ×8×2⅜	200	140	20·0	100
IB516C	4 ×8×2⅜	400	280	20·0	100

LUCAS

GEB

Joseph Lucas Ltd

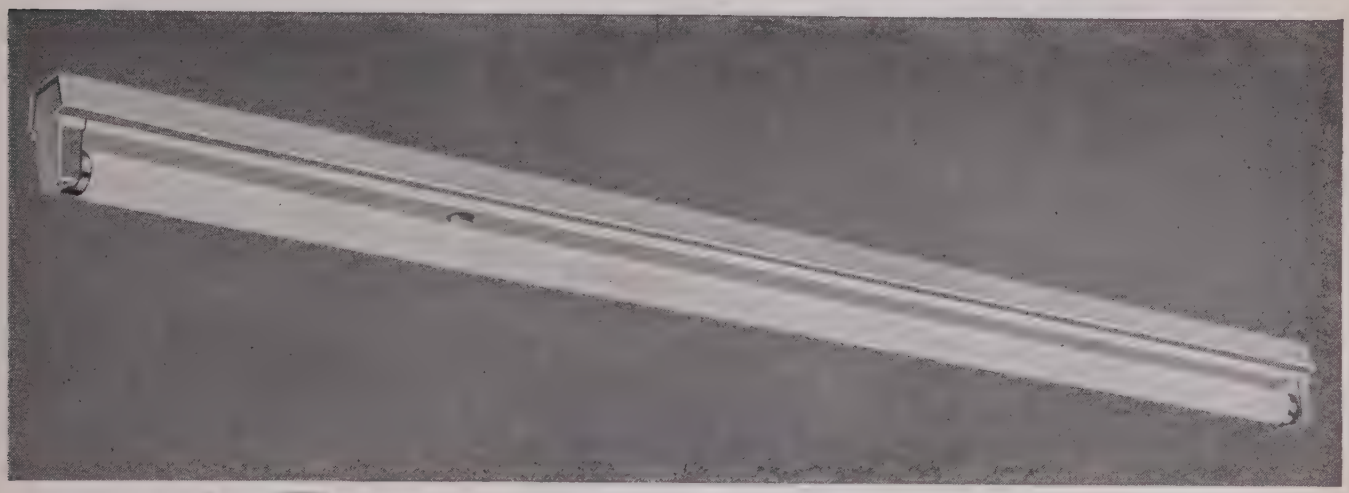
For further information and prices—apply to

G & E Bradley Ltd

SEMI-CONDUCTOR DIVISION. *Telephone* Gladstone 0012
ELECTRAL HOUSE, NEASDEN LANE, LONDON, N.W.10.

A Subsidiary Company of Joseph Lucas (Industries) Ltd.

BRITAIN'S FASTEST SELLING FLUORESCENT FITTINGS *



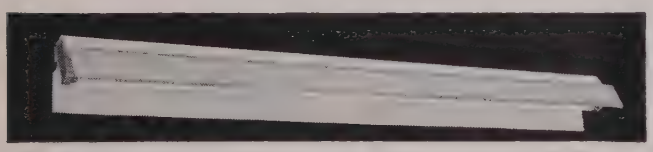
atlas SUPER-SLIM POPULAR PACKS

5 ft. fitting pre-packed complete with Atlas GP Quickstart Tube and control gear ready for installation.

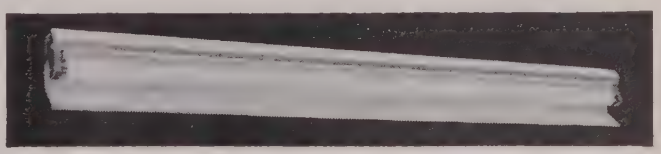
£4-11-4

inc. P. TAX

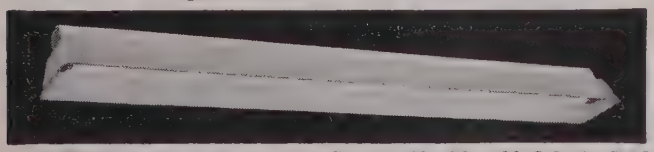
AND A COMPLETE SERIES OF ATTACHMENTS TO COVER A WIDE RANGE OF COMMERCIAL AND INDUSTRIAL APPLICATIONS



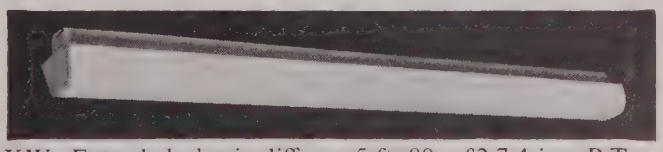
KZ: Metal trough reflector 5 ft. 80w £1.3.0 No P.T.



KX : Metal angle trough reflector 5 ft. 80w 18/- No P.T.



KY: Opal 'perspex' trough reflector 5ft. 80w £3.5.0 No P.T.



KW: Extruded plastic diffuser 5 ft. 80w £2.7.4 inc. P.T.

Super-slim chassis **Extremely light weight** **Totally enclosed chassis**

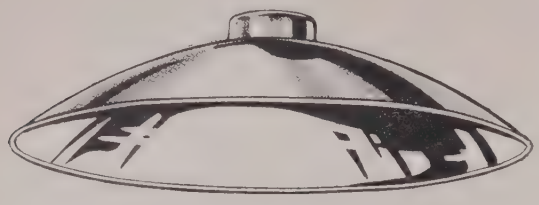
Compact control gear **Spring-loaded lampholders** **Available in 8 ft. 5 ft. 4 ft. and 2 ft.**

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We have installed new plant to enable us to extend our service to the electrical trade.

Deep Drawing up to 8″ depth. Finishes as required.

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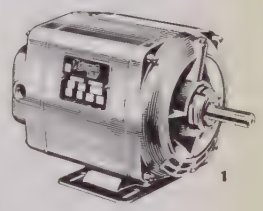
The Midland Metalworkers
MORCOM ROAD, GREET
BIRMINGHAM 11
Telephone : Acocks Green 2931

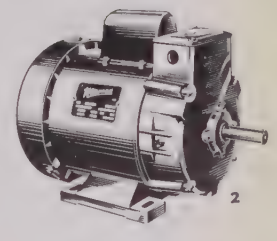


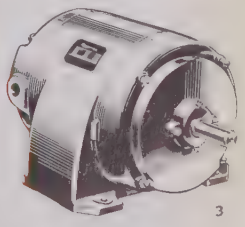
Newman

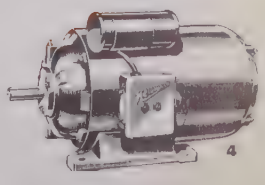
MULTI-RANGE MOTORS




1


2


3


4

1. Fractional horsepower Single-phase motors $\frac{1}{16}-\frac{1}{2}$ hp; split-phase or capacitor start; totally enclosed or drip-proof; foot, flange or resilient mounting; for standard or oil burner duty. (Three-phase also available $\frac{1}{16}$–1 hp.)
2. Totally enclosed single-phase motors $\frac{1}{3}$–$1\frac{1}{2}$ hp; capacitor start; foot, flange or face mounting. (Three-phase also available $\frac{1}{3}$–3 hp.)
3. Drip-proof Single-phase, $\frac{1}{3}-5$ hp; capacitor start; foot or flange and facing mountings (with feet). Capacitors fitted in motor feet for protection.
4. Totally enclosed Single-phase; $\frac{1}{3}$–$7\frac{1}{2}$ hp; capacitor start; foot or flange mounting.

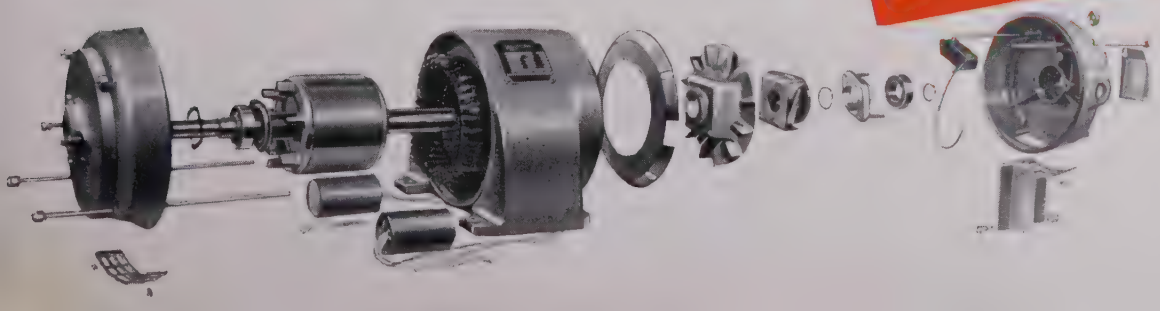
N°6 Single-Phase motors

This Newman range may be divided into two categories. Firstly there are the "conventional" single-phase versions of the fractional horsepower motors including both split-phase and capacitor start types as well as those designed expressly for oil burner duty.

The second category includes the industrial single-phase motors, in drip-proof or total enclosure, designed to "bridge the gap" between fhp and the higher ratings up to $7\frac{1}{2}$ hp.

By the nature of their field of application single-phase motors must be exceptionally robust and reliable — Newman single-phase motors are built and tested to a high standard of quality.

Newman



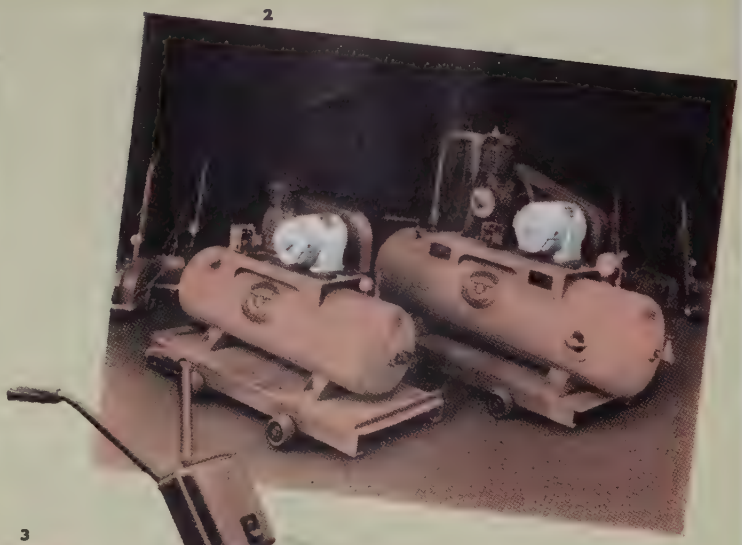
Single-phase motors at work

1



The "Rob Roy" concrete mixer, by James F. Low of Monifieth, which is powered by a TEFC Newman 1 hp single-phase motor.

2



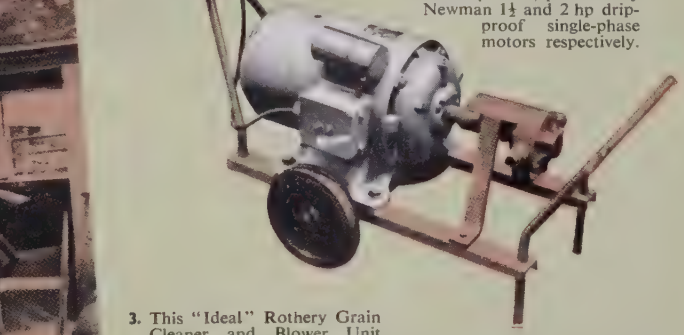
2. Models '70' and '100' compressors by Air Industrial Developments, powered by Newman 1½ and 2 hp drip-proof single-phase motors respectively.

3



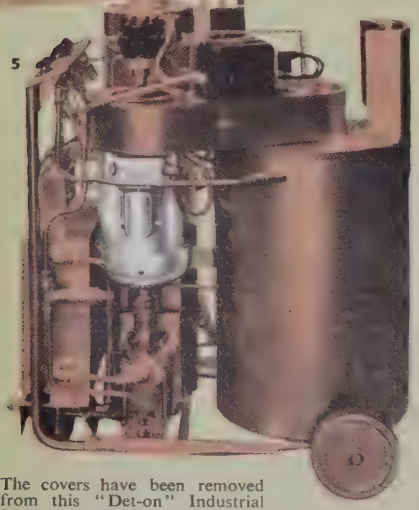
3. This "Ideal" Rothery Grain Cleaner and Blower Unit (manufactured by Gordon Felber & Co. Ltd.) incorporates a Newman single-phase 'ELF' fractional horsepower motor.

4



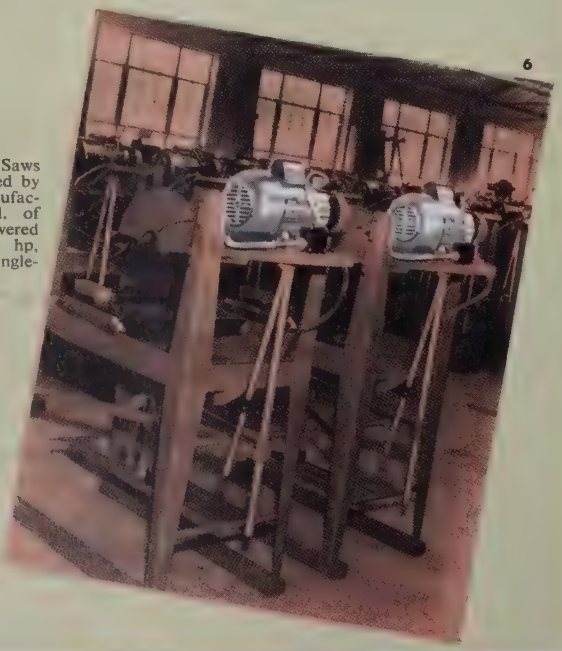
4. A Newman TEFC Single-phase motor drives this "Neptune" High Pressure Water Pump manufactured by Opancol Limited of London.

5



5. The covers have been removed from this "Det-on" Industrial Steam Cleaner made by Wanson Company Ltd., to show the Newman TEFC single-phase motor which powers it.

6



6. These Masonary Saws are manufactured by the Clipper Manufacturing Co. Ltd. of Leicester and powered by Newman 1½ hp, '66' frame, single-phase motors.

ELECTRIC MOTORS TO 600 h.p.

Newman

NEWMAN INDUSTRIES LIMITED - YATE - BRISTOL - ENGLAND

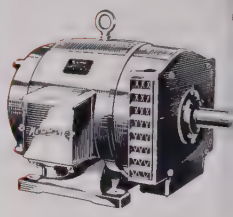
Telephone: Chipping Sodbury 3311 Telex: 44121 Telegrams and Cables: Dynamo Yate

TI

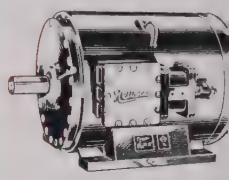
NEWMA

RANG

Some of the other typ of Newman moto availa



DRIP-PROOF SQUIRREL CAGE MOTORS
British Standards 75–600 h (List No. 103). American Sta dards (List No. 104).



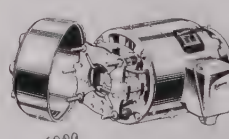
FLAMEPROOF MOTORS —STEEL FRAME
(Buxton Certified.)
British Standards 5–200 h (List No. 702). (Also availab to NEMA Dimensions.)



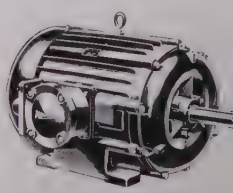
TOTALLY ENCLOSED MOTORS
With Double Air Circu Cooling. British or Americ Standards. NEMA Dime sions, 25–250 hp. (List N 305).



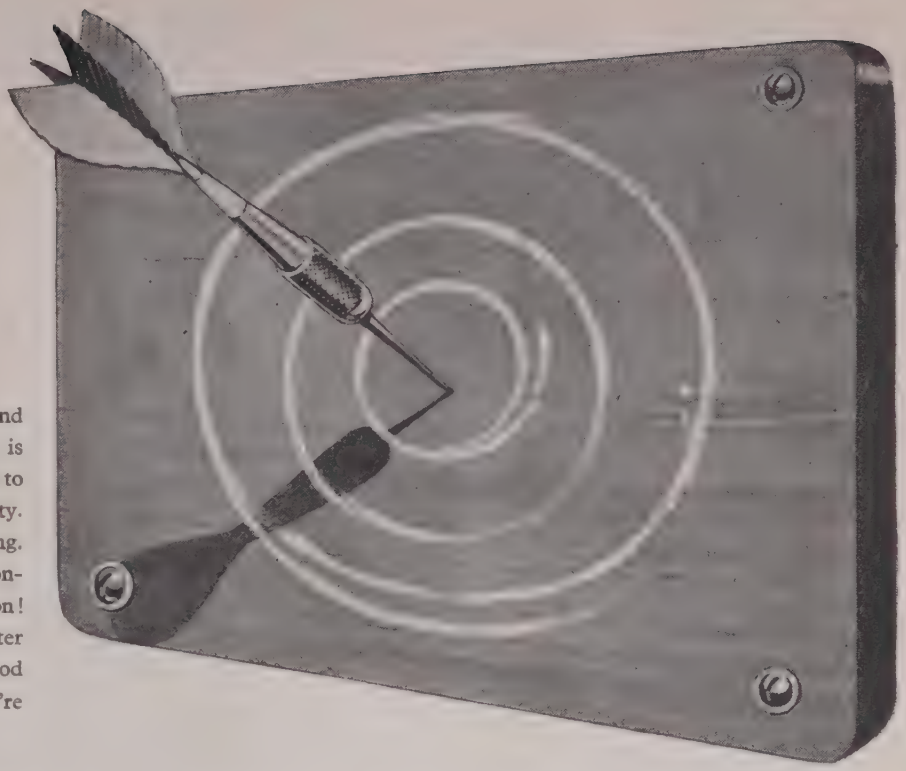
VERTICAL HOLLOW & SOLID SHAFT DRIP-PROOF PUMP MOTORS
British or American Standard NEMA Dimensions. 10–300h (List Nos. 602 & 604).



BRAKE MOTORS
Drip-proof, totally enclosed flameproof. Retarding torque 2.9 lbs. ft. to 120 lbs. f ⅛–40 hp. (List No. 801).



FLAMEPROOF MOTORS
(Buxton Certified and Under writer Approved.)
British or American Standards New NEMA Dimensions ½–200 hp. (List No. 703).



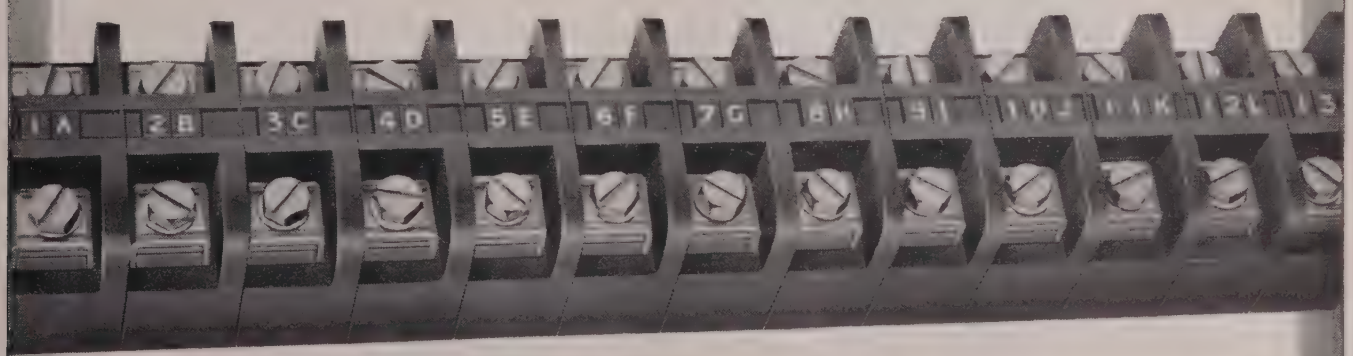
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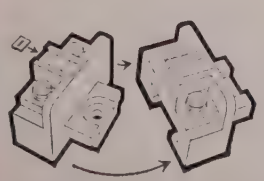
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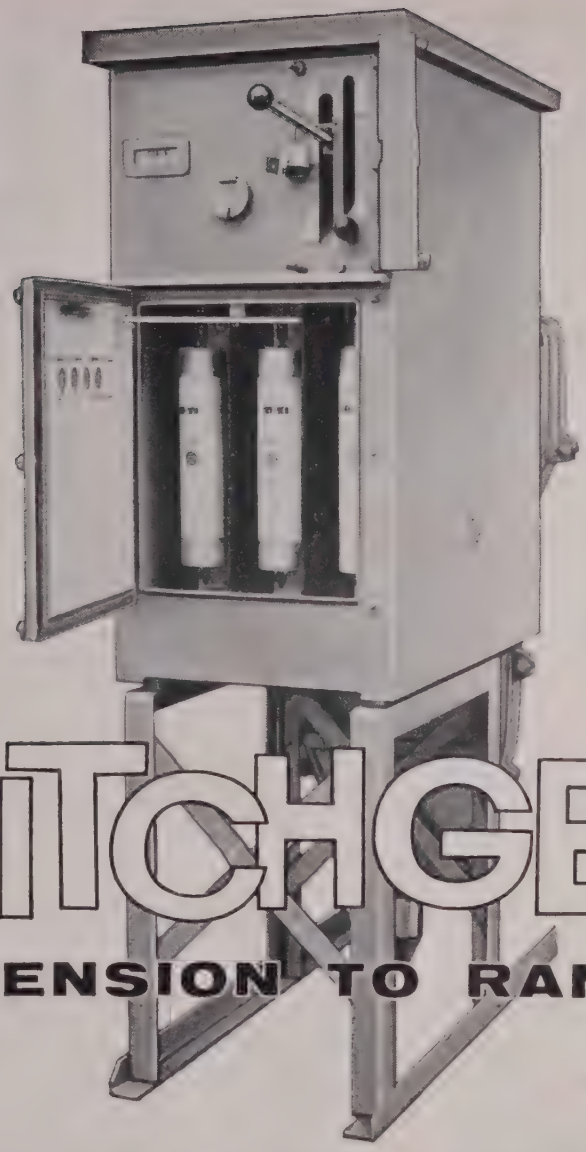
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BRUSH

BRUSH ELECTRICAL ENGINEERING CO LTD

LOUGHBOROUGH ENGLAND

A Member of the Hawker Siddeley Group

Type HF 11 Switch-Fuse unit, with chamber door open, showing 90 ampere 11 kV fuse-links.



S7

DANGER

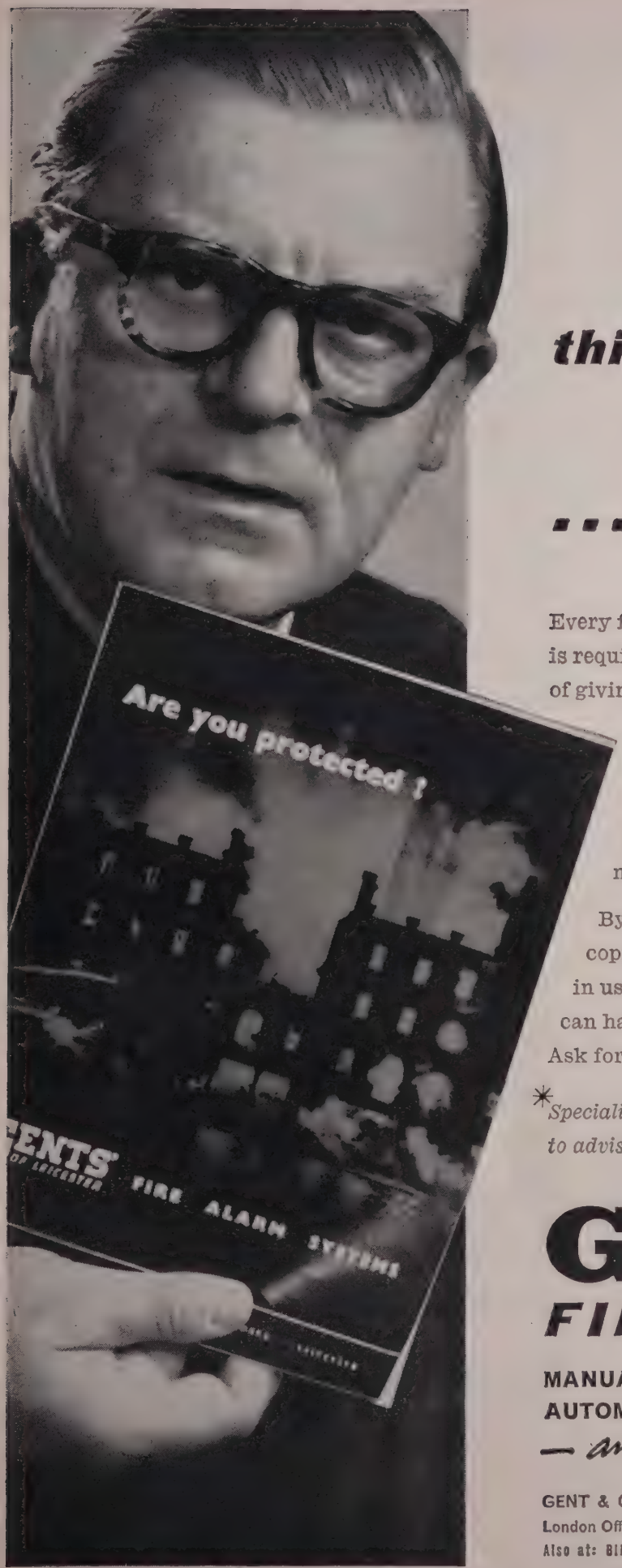


Skate on the thinnest ice: step on the conductor rail: cross Piccadilly Circus from Northwest to Southeast: but remember that **ASSOCIATED LEAD** are the most reliable and economical suppliers of **LEAD, TIN, ANTIMONY AND THEIR ALLOYS; 99.999% PURE LEAD, TIN AND ANTIMONY; SOLDERS, INCLUDING SOLID AND CORED SOLDER WIRE, ANTI-FRICTION MATERIALS; ANTIMONIAL LEAD; CABLE ALLOYS; LEAD SHEET AND PIPE; DENSE LEAD SHIELDING FOR NUCLEAR WORK.** The dangers involved in forgetting this simple fact are too numerous to name: but, to put it shortly, it is a matter of profit and loss.

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OF LEICESTER

FIRE ALARMS

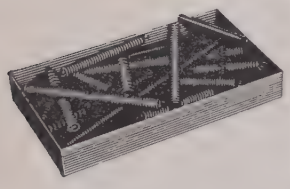
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No. 757. Extra Light Compression, 1 gross Assorted, $\frac{1}{8}$″ to $\frac{7}{16}$″ diam., $\frac{1}{2}$″ to 2$\frac{1}{2}$″ long, 27 to 19 S.W.G. **15/-.**



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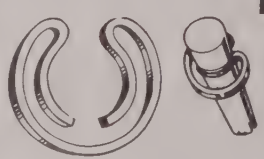
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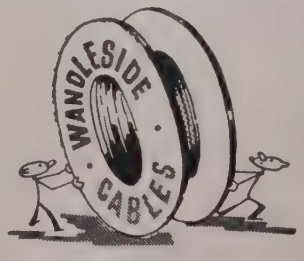


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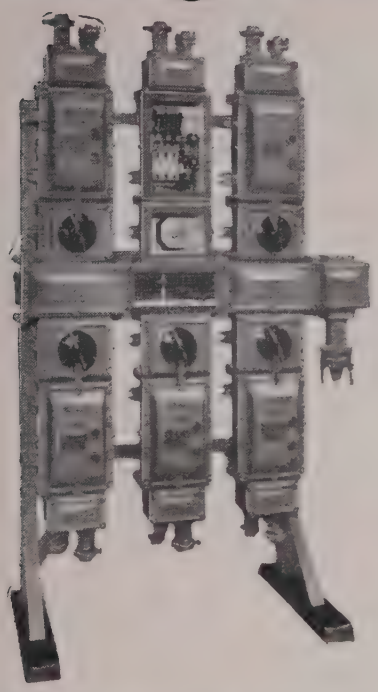


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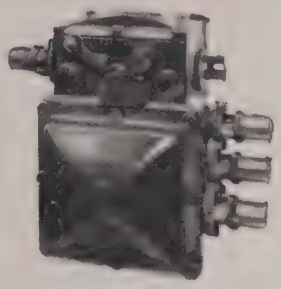
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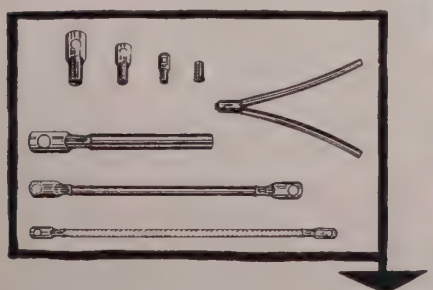
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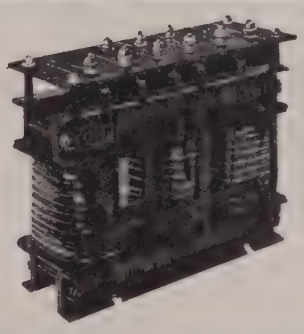
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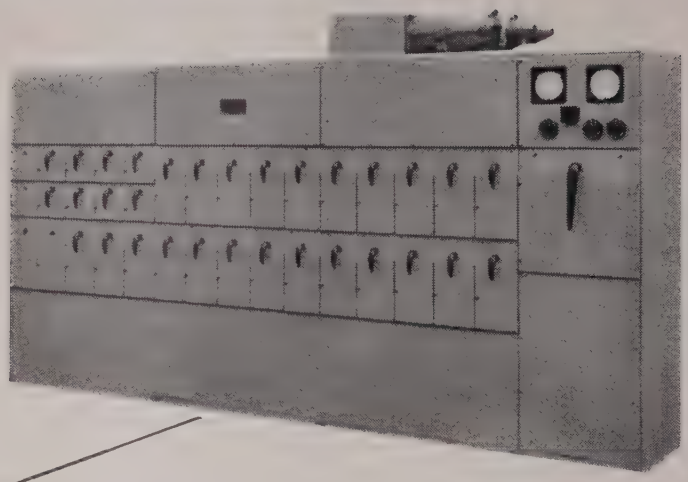
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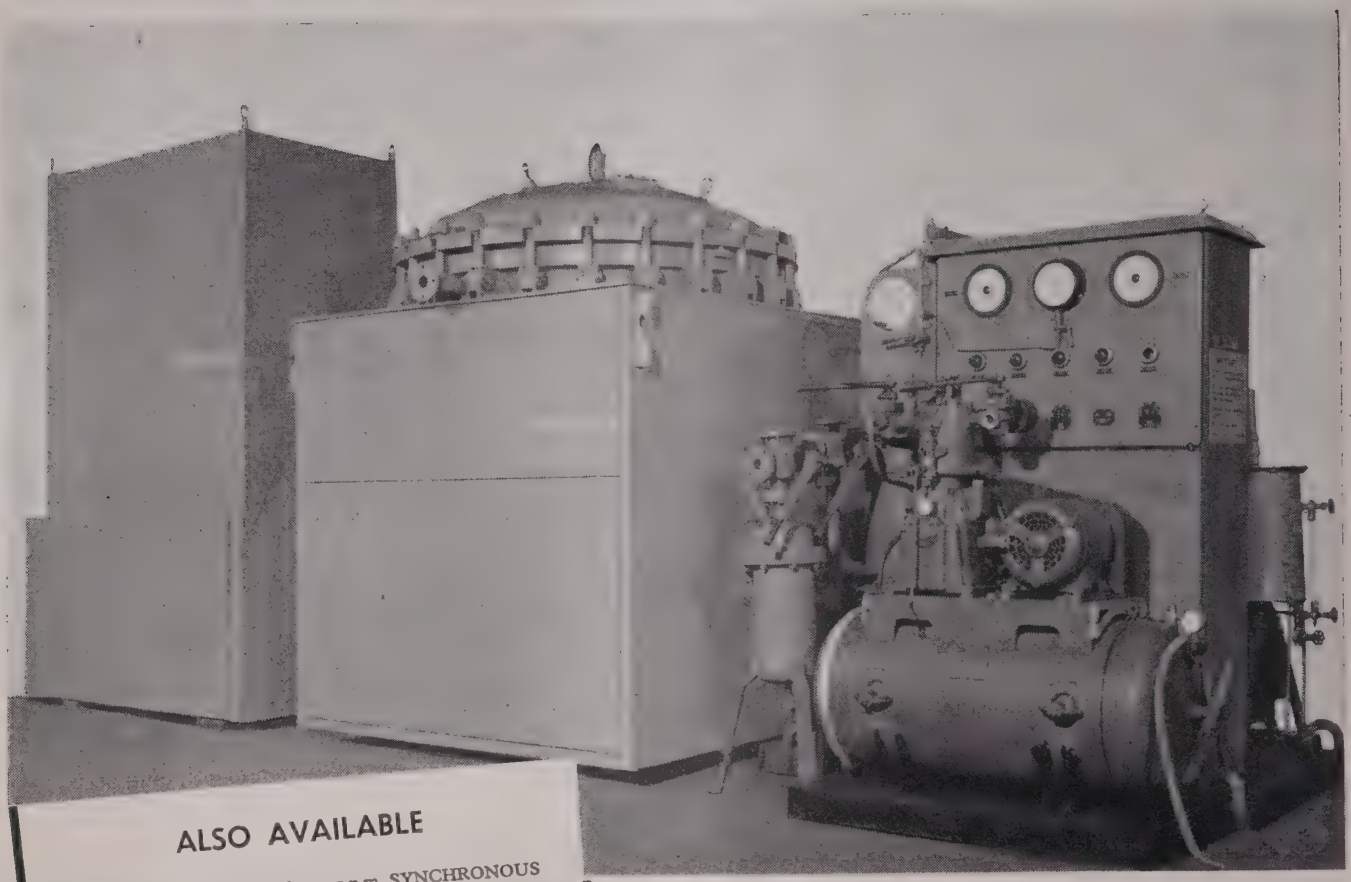
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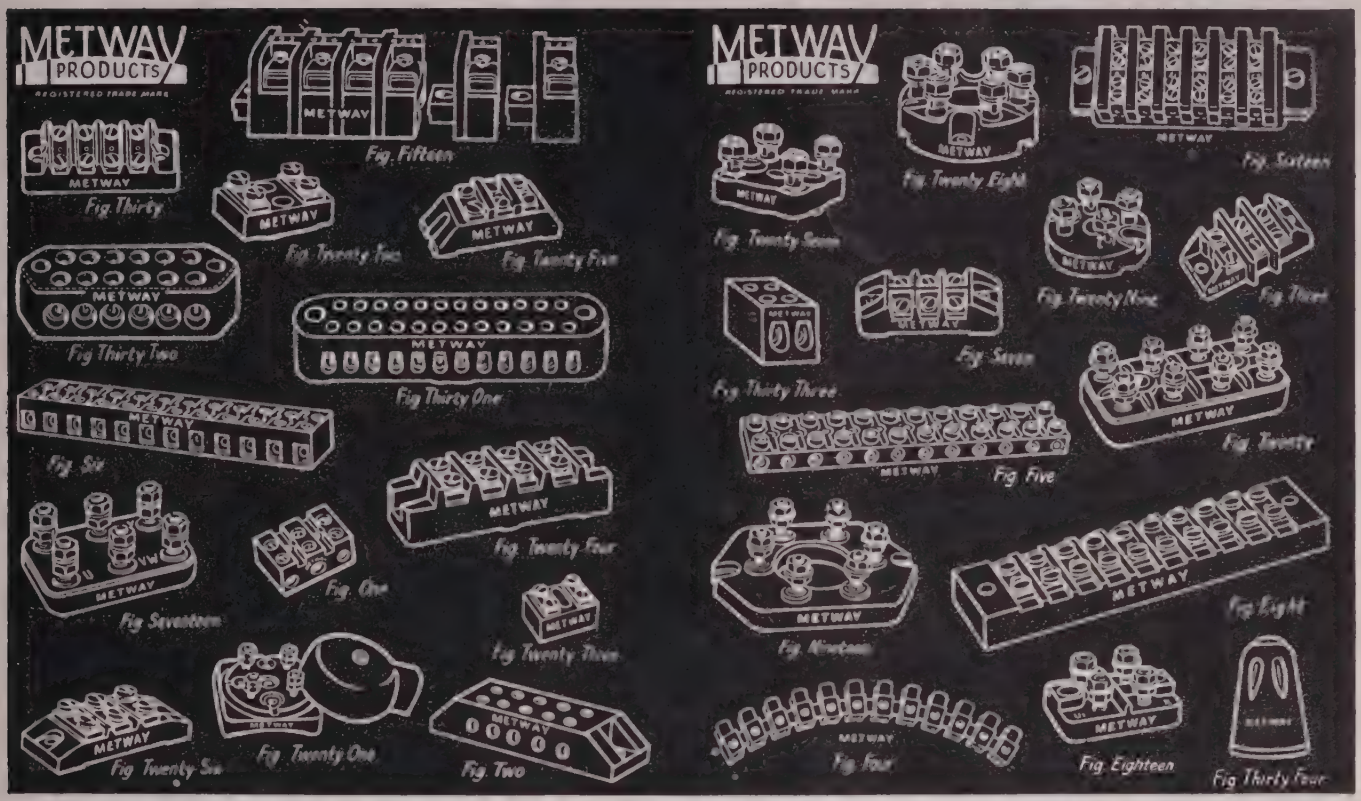
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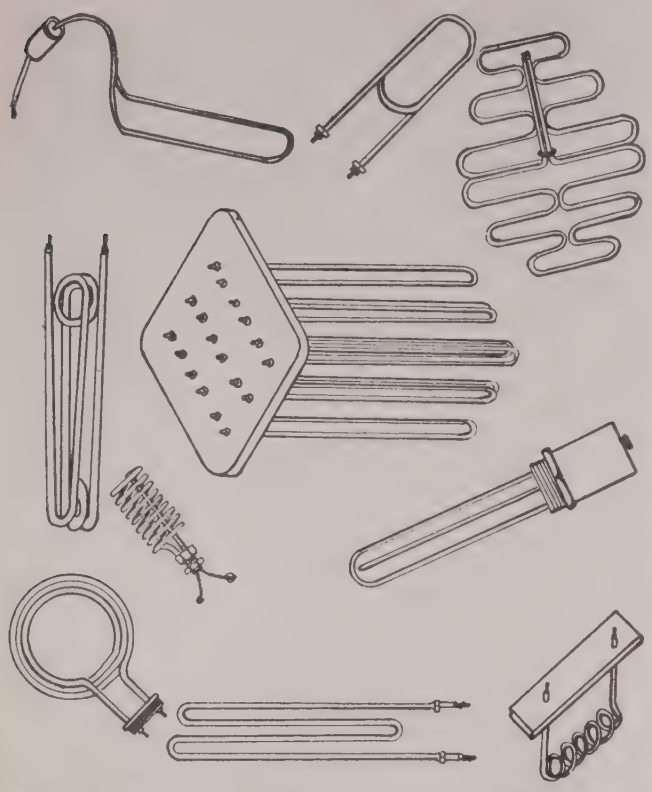
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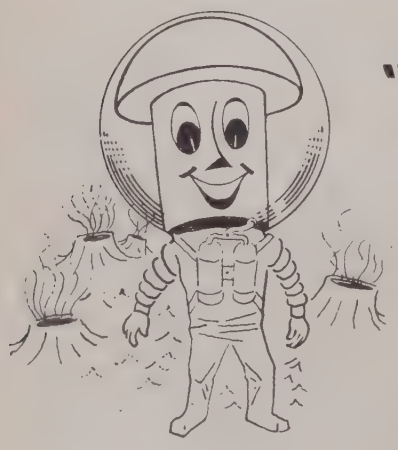
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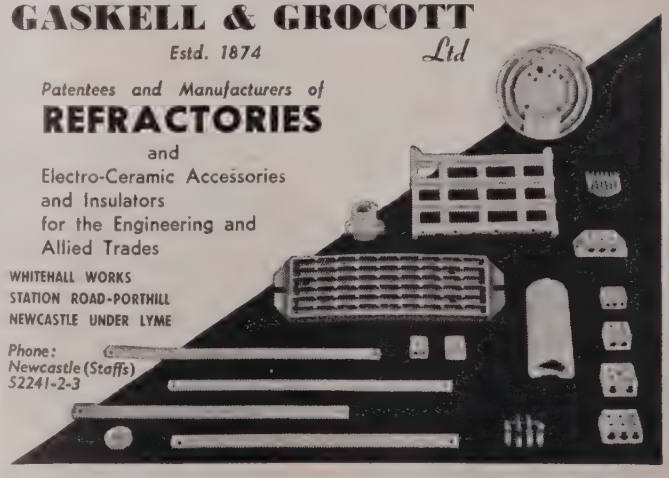
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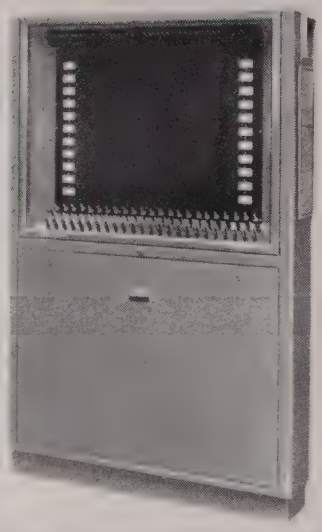
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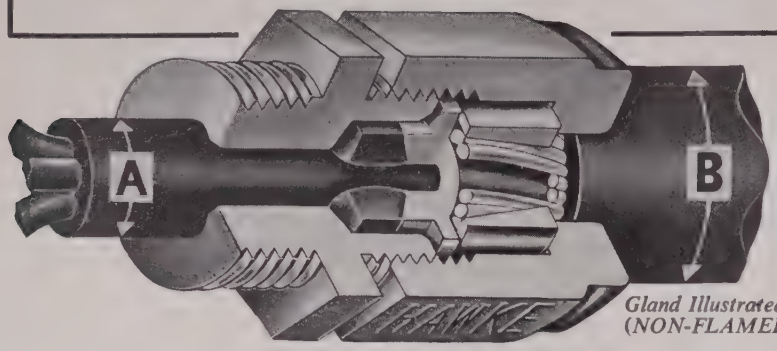
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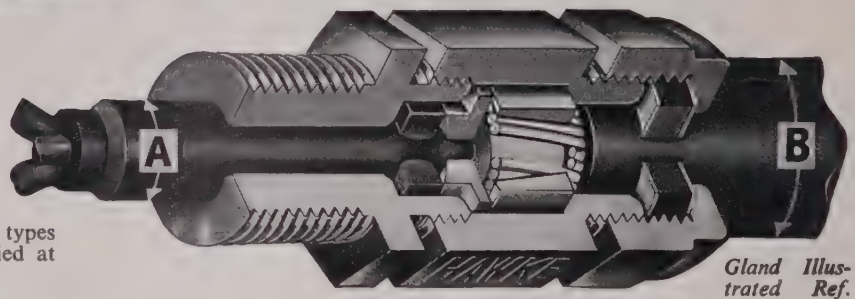


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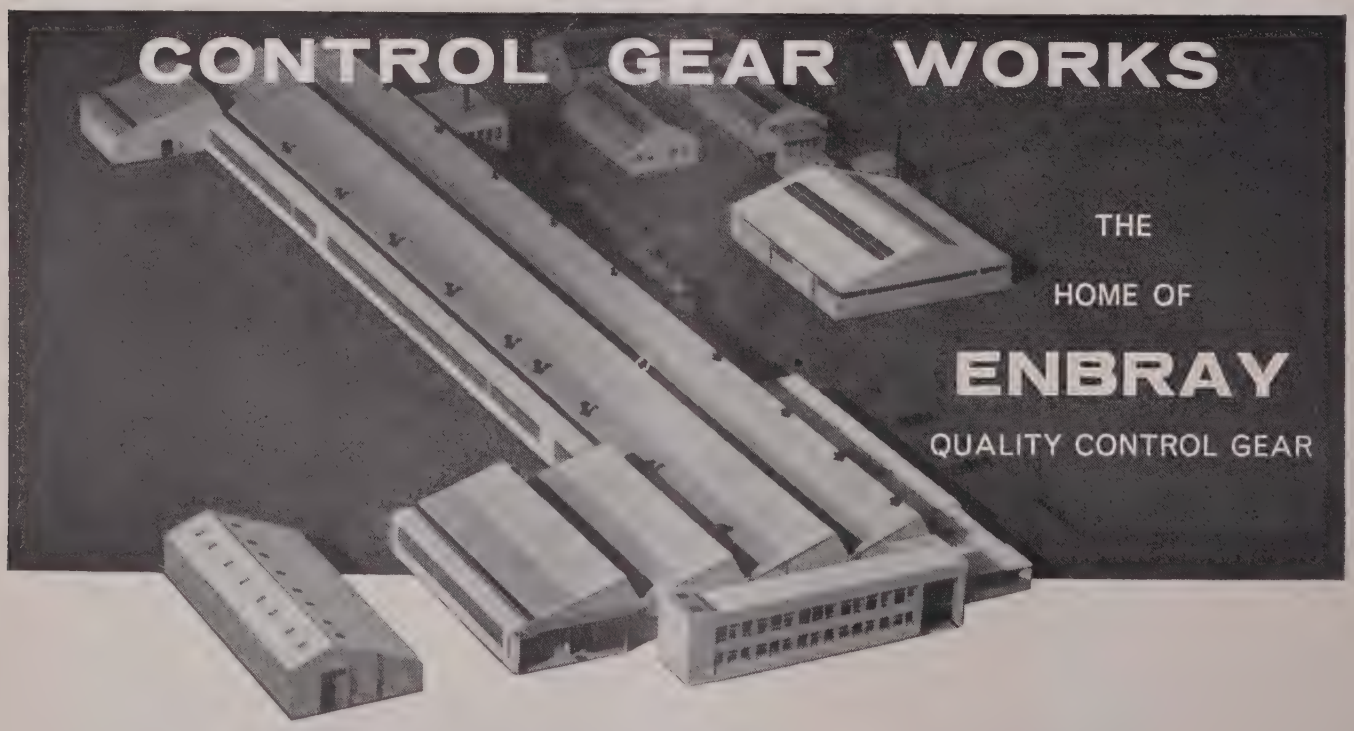
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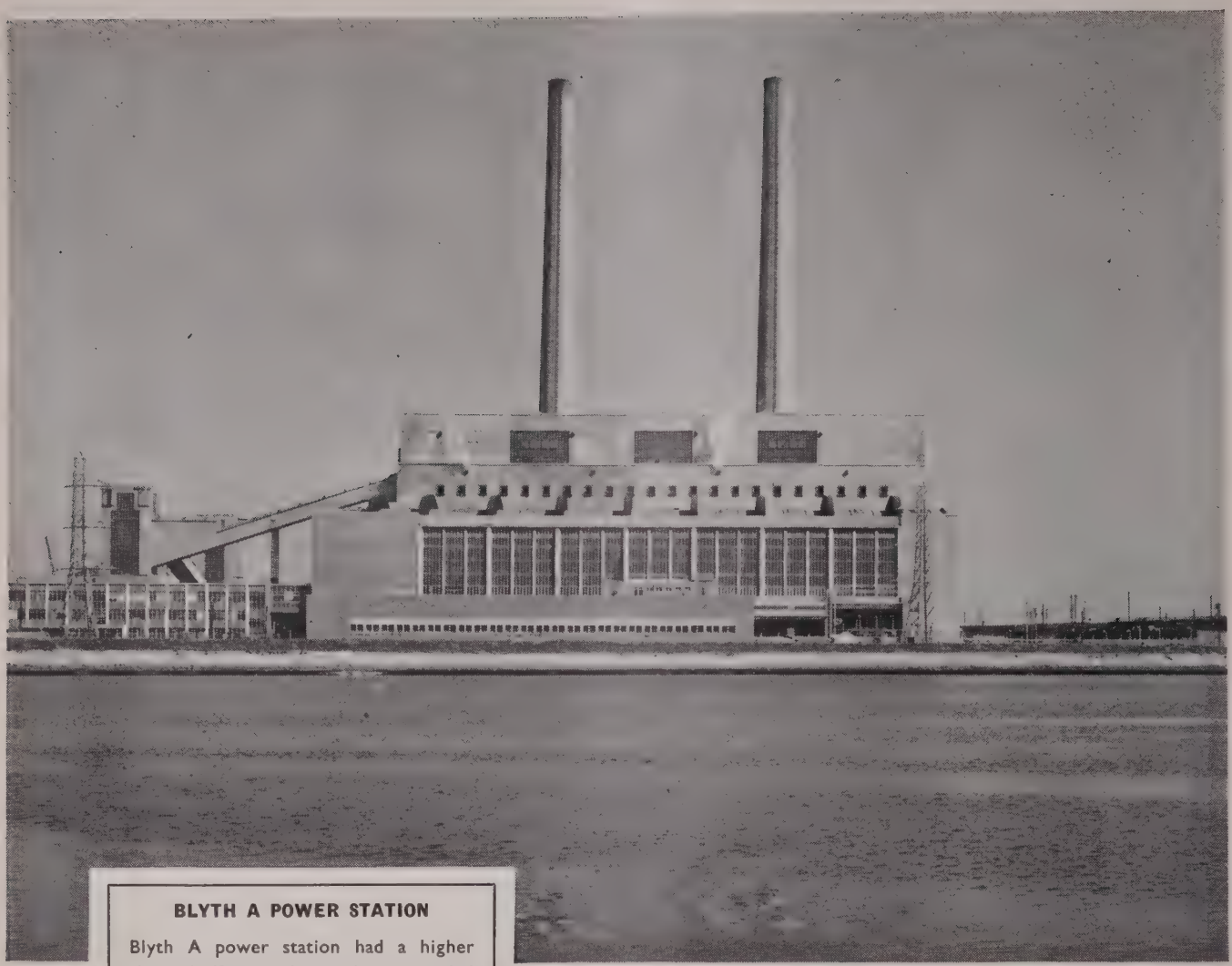
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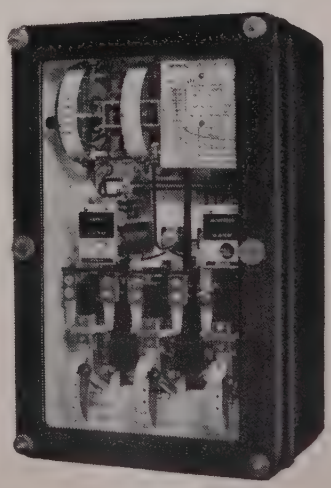
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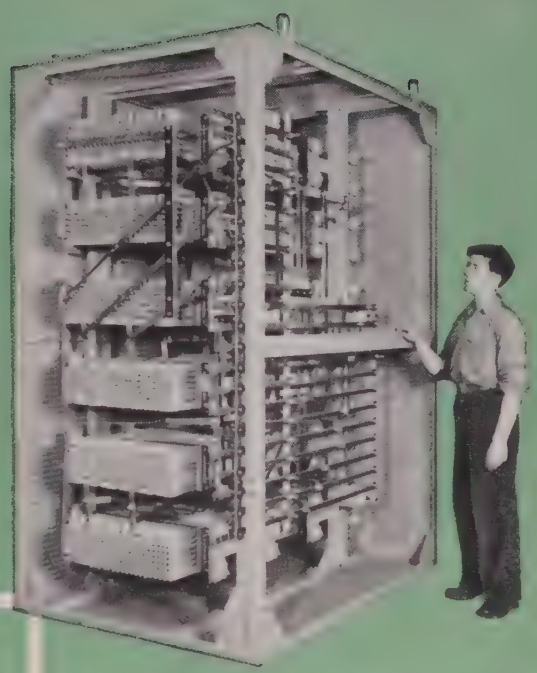
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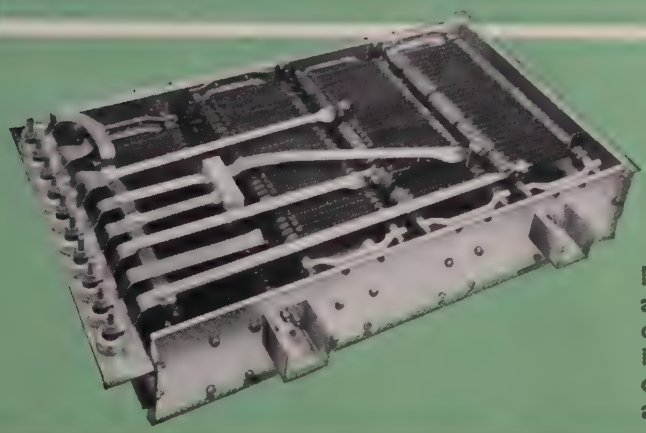
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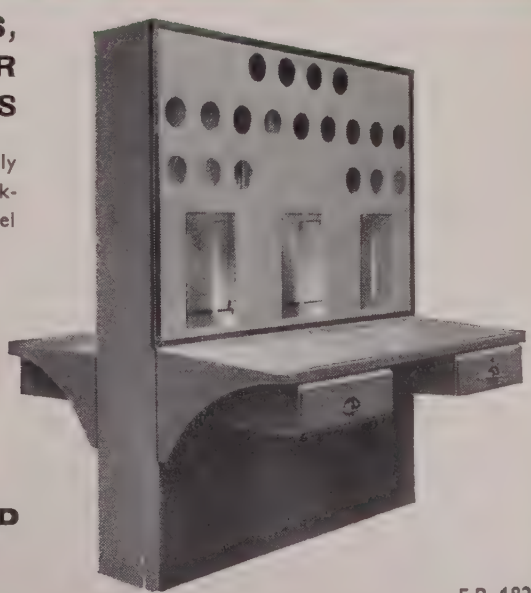
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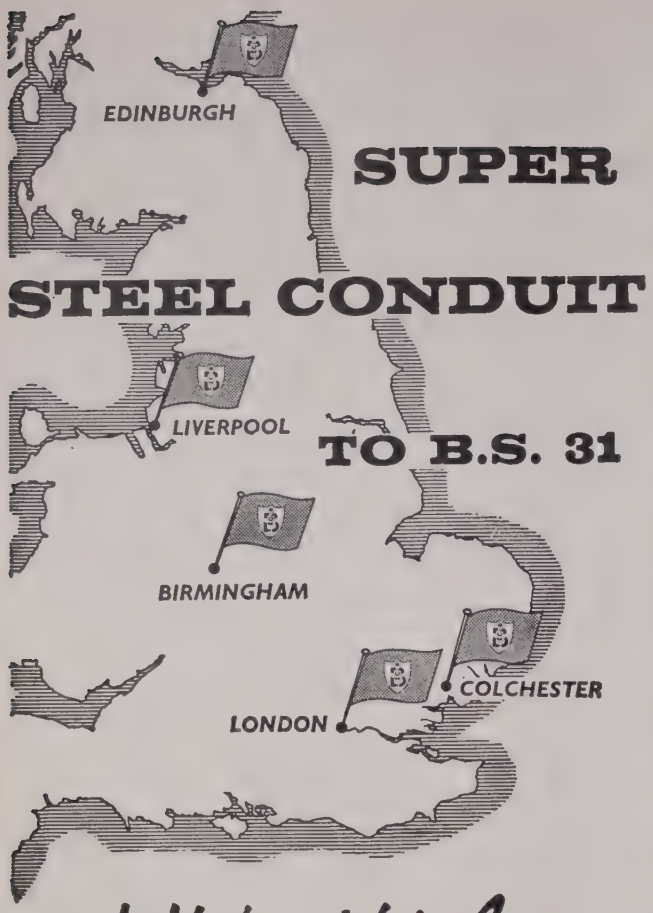


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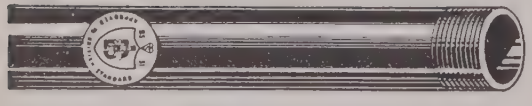
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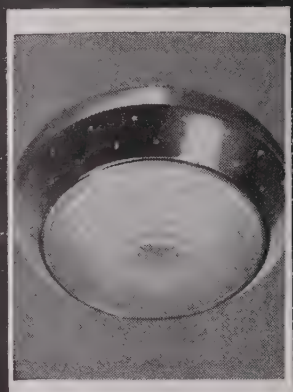
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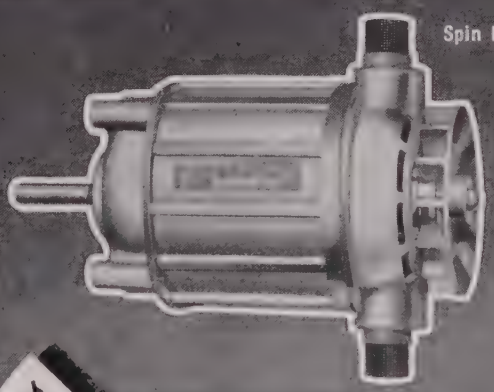
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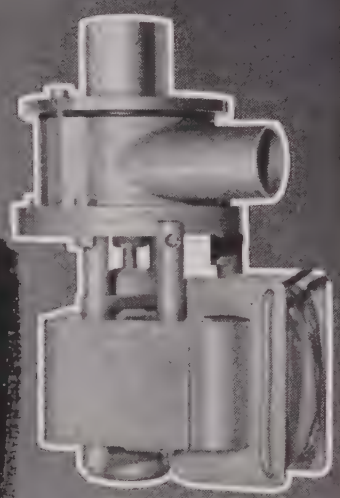
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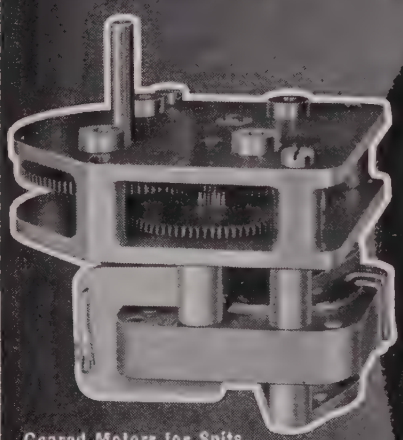
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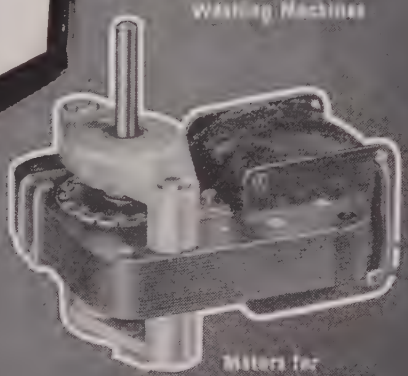
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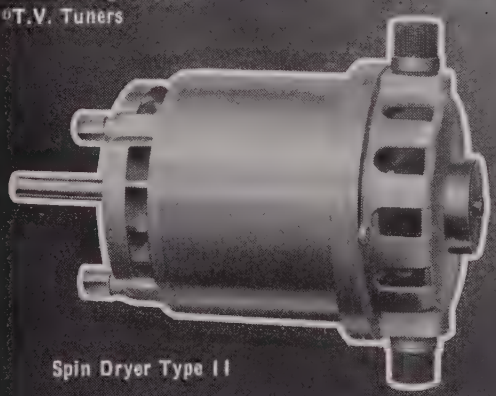
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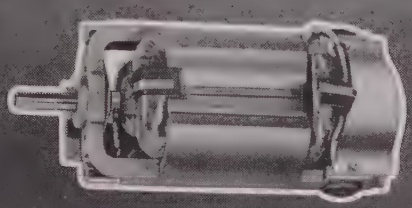
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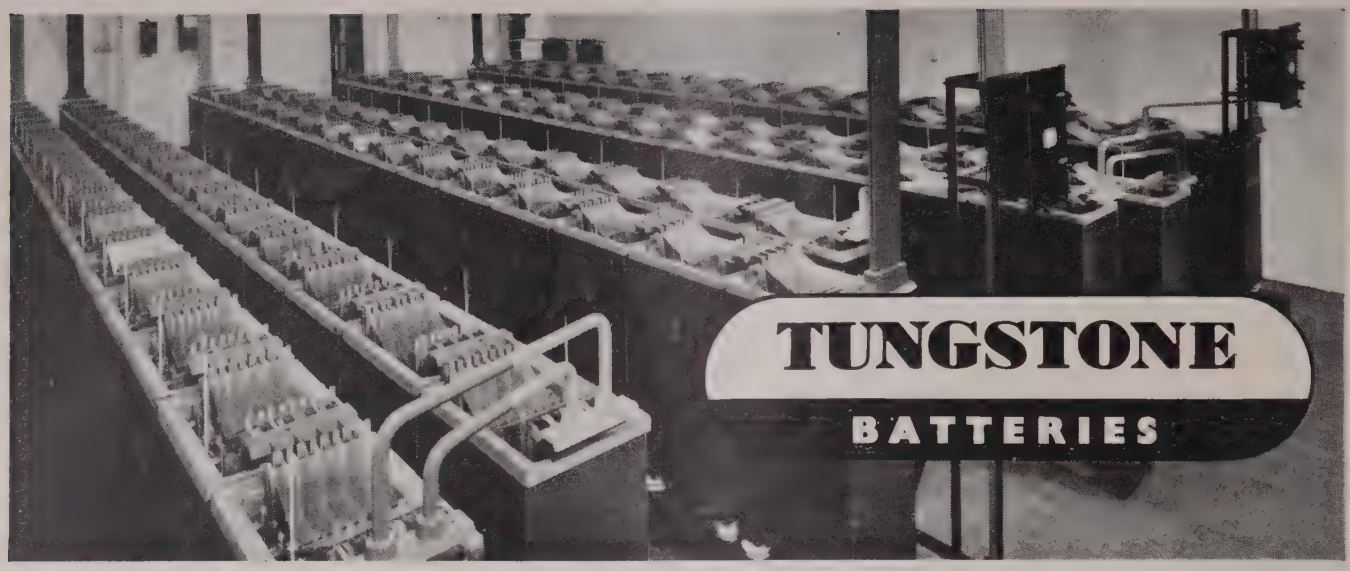

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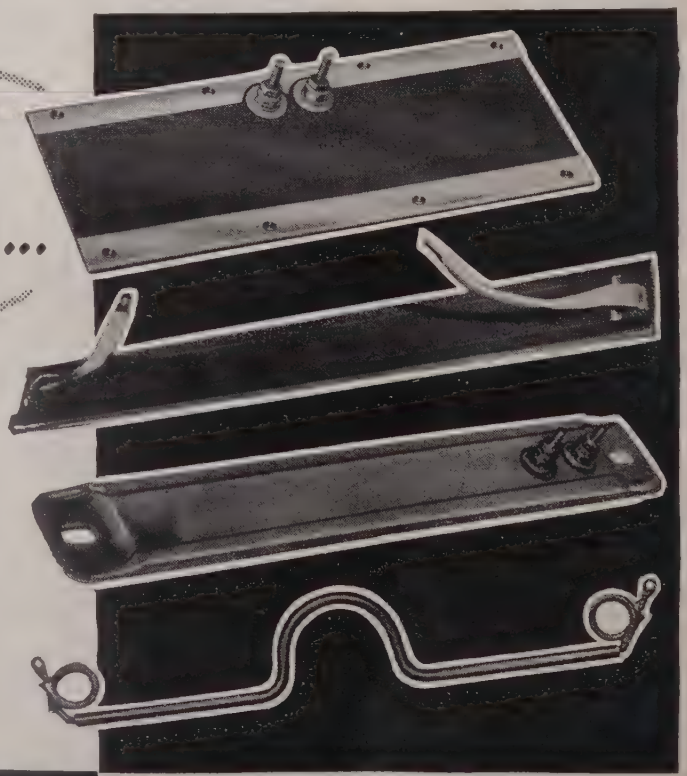
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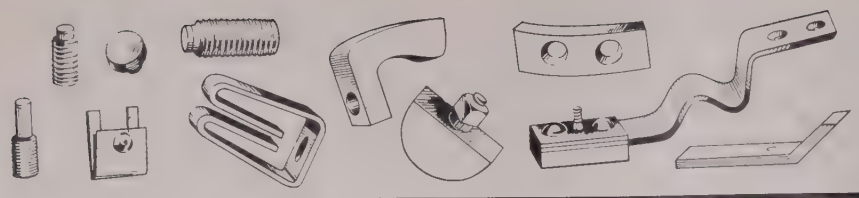
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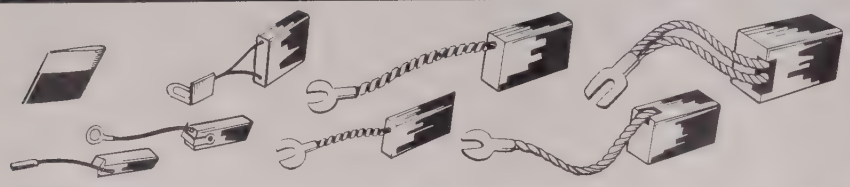


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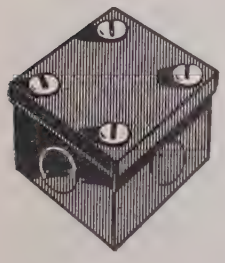
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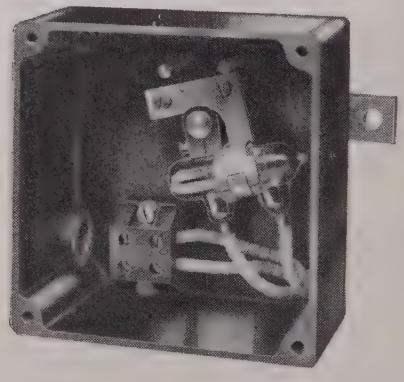
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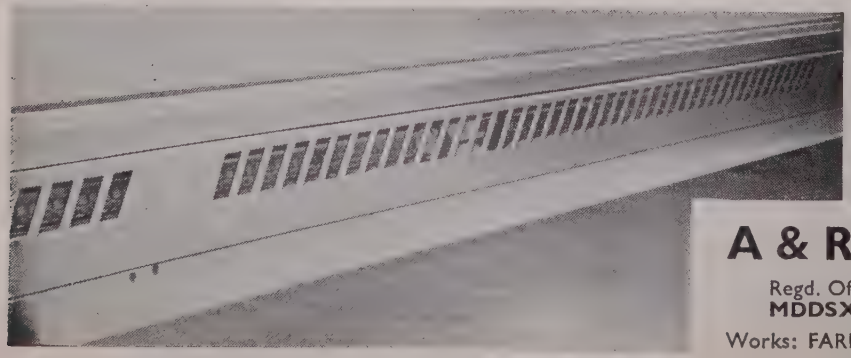
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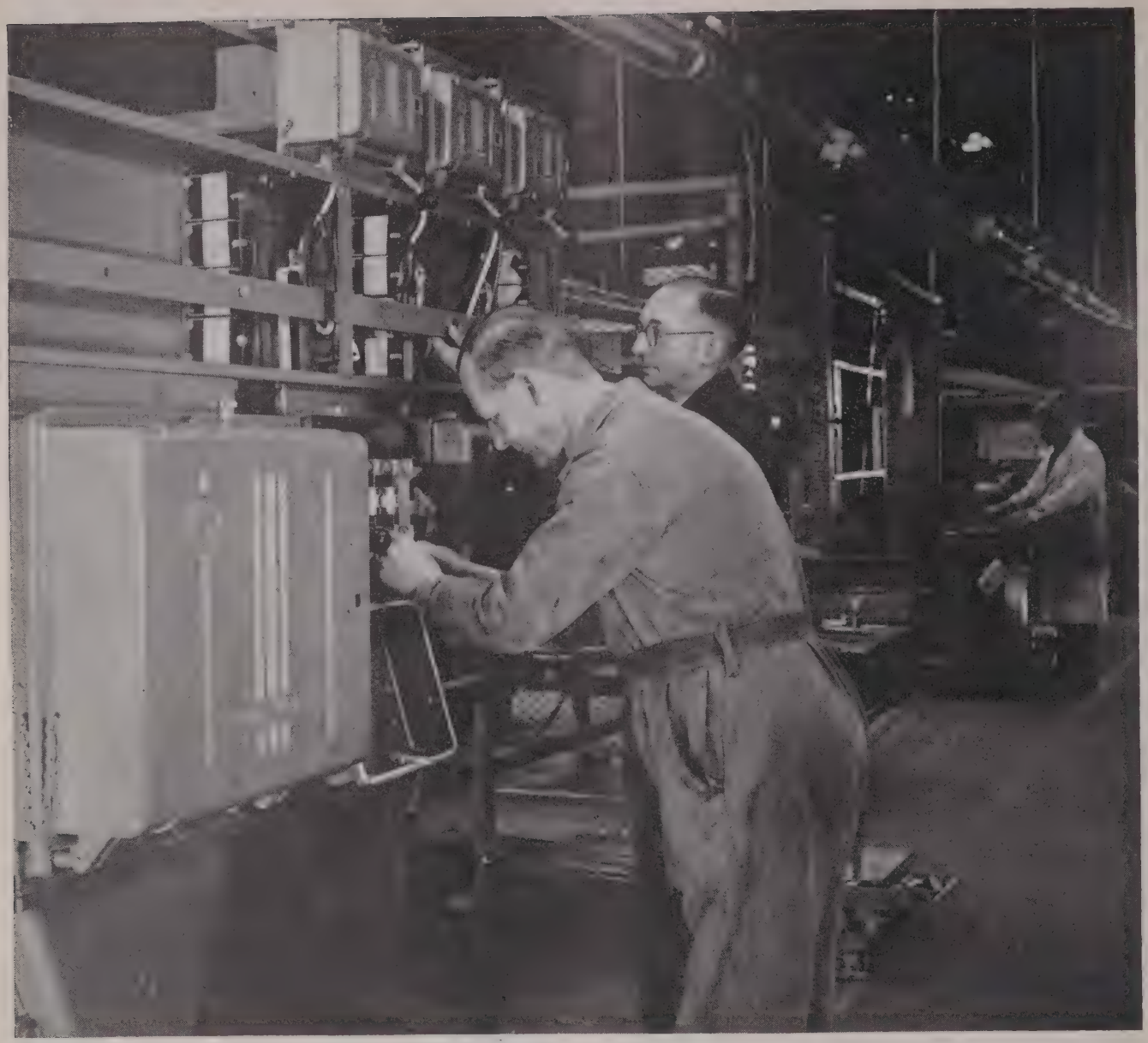
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ELECTRICAL REVIEW

Friday 6 January 1961 Volume 168 No 1

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Present plans include the uprating of the 275 kV supergrid to 400 kV. Research is also being carried out on d.c. transmission

3 Silicon-Controlled Rectifier

This new semiconductor device is the solid state equivalent of the gas thyratron. The author discusses its theory of operation and characteristics

7 Belvedere Switching Station

The switchgear for the four 60 MW and two 120 MW turbo-generators at Belvedere power station is housed in an adjacent hall type substation. A factor in the decision to adopt this form of construction was the susceptibility of the site to flooding

12 High-Speed Brushless Alternator

The machine described employs a stationary armature core made from strip magnetic material coiled up in a roll

16 West Thurrock — Northfleet Crossing

Two specially designed 615ft towers will support the 4,500ft long supergrid span across the Thames between West Thurrock and Northfleet. The crossing will connect the main 275 kV network with the new line to Lydd and the cross-Channel cable

21 Electronics in the Supply Industry

Summary of the Third Hunter Memorial Lecture which was given at the Institution of Electrical Engineers yesterday (Thursday) by Dr. J. S. Forrest, Director, Central Electricity Research Laboratory, Leatherhead

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Domestic Supplement: Spin and Tumbler Dryers — Inside Back Cover

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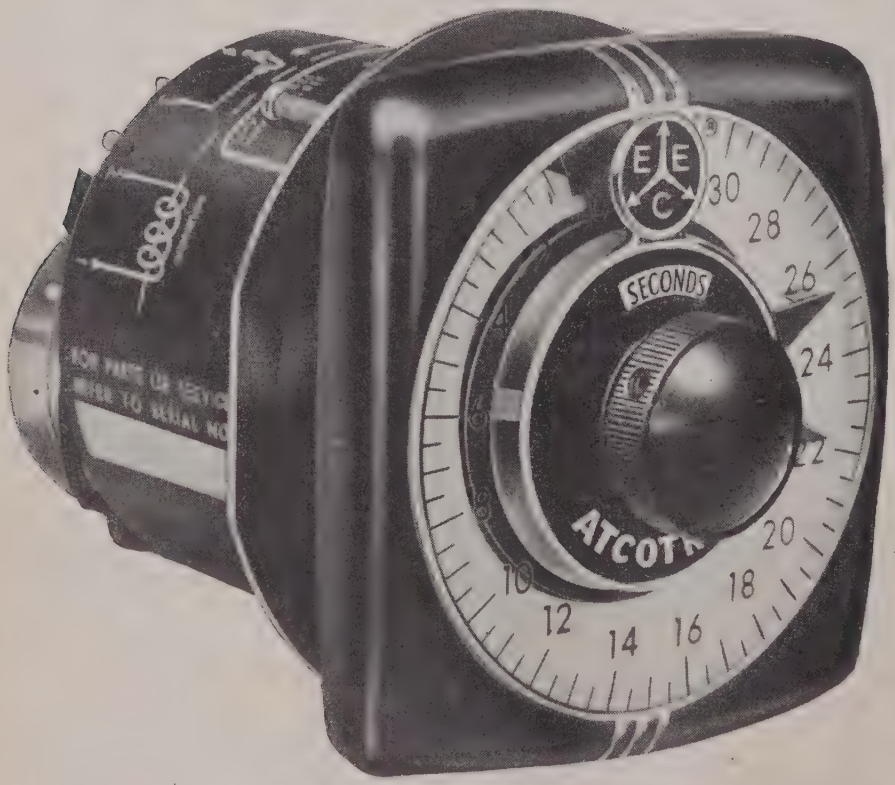
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6 January 1961 Vol. 168 No. 1 Established 1872

Transmission Developments

So much is talked and written about the outstanding developments which are taking place in connection with power stations and generating plant, both nuclear and thermal, that progress in the field of electrical power transmission is perhaps overshadowed. The design and construction of high voltage overhead power lines is not just a matter of stringing a collection of conductors from tower to tower across the countryside and, where possible, placing this arrangement out of the sight of the increasing number of lovers of unspoilt countryside. There is far more to it than that. Transmission projects require careful planning and design and generally have to take into account many conflicting requirements and interests. The supergrid, for instance, was planned so that basic load was supplied from economically operating power stations in the Midlands coalfields to other parts of the country, particularly southern England.

However, the advent of the civil nuclear power programme changed the situation, due to a combination of the ability to site the stations in remote places and the virtually negligible cost of transporting nuclear fuel. The 275 kV network will now be employed to provide mutual support between the main centres of generation and this includes both thermal and nuclear plants.

A few weeks ago it was announced by the Central Electricity Generating Board that it had been decided to uprate the 275 kV supergrid to 400 kV, but operation at this voltage is unlikely to commence before 1965. Although there is no economic advantage to be gained by adopting 400 kV in this country, the resultant higher power carrying capacity will markedly mitigate the impact of transmission development on amenities. Obviously the number of high voltage transmission lines needed to meet the country's increasing power demands will be reduced by the conversion to this higher voltage. Throughout the country, all those firms who are concerned with the manufacture or construction of power transmission equipment are pursuing vigorous programmes of development. For example, Doultons, in conjunction with the French firm of Merlin-Gerin, have produced a new 380 kV post-type insulator. With an eye to the future, the C.E.G.B. is starting research on d.c. transmission at Brighton " B " power station, where the English Electric Co. is also about to undertake the development of mercury arc rectifiers. With bigger towers and heavier insulators, considerable interest is attached to the work which the Electrical Research Association is doing in connection with the effects of wind pressure on steel

structures. Altogether the industry is tackling a wide and varied programme of development. Construction work on the 275 kV system is still continuing, however, particularly in the southern part of the country. The major part of this extension is into south eastern England and this includes the Thames crossing between West Thurrock and Northfleet. A detailed description of this project is included in this issue. This crossing will connect the main 275 kV network with the new line now under construction to Lydd. It is hoped that both the crossing and the line to Lydd will be in operation by the end of 1961, when the 200 V d.c. submarine link between this country and France should be ready for commissioning.

CIRCUIT-BREAKER DESIGN

We have often commented on the remarkable developments in the supply industry over the last few years. Individual generating units of 350 MW capacity and over are now being constructed while a 275 kV supergrid system has been operating for some time. With these achievements, developments in standard auxiliary apparatus have perhaps been overlooked. The proposed uprating of the supergrid to 400 kV has, however, directed more attention to transformers and circuit-breakers.

The development of high-voltage circuit-breakers can be traced from bulk-oil devices followed by those with a low oil content to compressed-air types. To meet the stringent present-day requirements, however, manufacturers are endeavouring to develop new types of arc-extinguishing fluids. Over ten years ago, after extensive tests, the Westinghouse Corporation selected sulphur hexafluoride (SF_6) gas, which was found to be non-toxic, non-inflammable and to have a high dielectric strength. Its coefficient of thermal conductivity is greater than that of air and this leads to more rapid heat dissipation. The first SF_6 circuit-breaker, which was recently completed by Westinghouse, has a continuous capacity of 1,600 A at 230 kV. As the breaker does not exhaust to atmosphere, it is noiseless in operation. British manufacturers are, of course, always investigating new types of circuit-breakers but none of them has so far announced any departure in this direction.

APPLIANCE APPROVAL

Progress is reported by the British Electrical Approvals Board for Domestic Appliances (mercifully abbreviated to "B.E.A.B.") in its scheme for giving its cachet to appliances in the first group to be dealt with—fires, kettles and vacuum cleaners. Authorisation will be given at the end of February for successful applicants to start using the Board's mark. That mark is now in course of preparation. Now the Board has specified its second group—shavers, toasters, coffee percolators and wash-boilers—and has invited manufacturers to submit their products for approval.

It has been decided that there should be one British Standard Specification (B.S. 3456) to cover the whole of the testing and approval of domestic electrical appliances but it is to appear in a number of parts, each part being divided into appropriate sections.

So far so good. But the success of the scheme depends upon the public's acquaintance with it. This means that the manufacturers and the Electricity Boards must publicise it and establish the approvals mark as a guarantee of soundness and safety.

EUROPEAN TRADE DIVISION

The New Year marked an important stage in the advancing division of Europe into two trading blocks. Following their accelerated timetable, the six countries of the European Economic Community on 1st January not only made a third reduction of 10 per cent in their internal tariffs, but for the first time adjusted their tariffs against non-members. This initial move towards a common tariff means that electrical goods, and most other imports, into the low-tariff countries of West Germany and Benelux will now pay more while the duties on those to the high-tariff countries of France and Italy will be lowered.

Unfortunately, the attempt to offset the mounting discrimination in the Common Market by a similar acceleration of the tariff cuts among the seven countries of the European Free Trade Association has not proved possible. In any case it is doubtful whether in the electrical field, at least, there is any great scope for making up in the "Seven" what may be lost in the "Six." Our electrical exports to the Common Market are half as large again as those to the E.F.T.A. countries and growing no less rapidly. To West Germany, on the other hand, it is the E.F.T.A. countries which are the most important and in recent years the growth of Germany's exports has been greatest to those countries, such as Sweden, where British manufacturers should have an advantage.

USE AND ABUSE

In a recent letter in the *Daily Telegraph* Mr. L. C. Howitt, the Manchester city architect, commented adversely upon a letter addressed to certain town clerks by the Institution of Municipal Engineers. It seems that this Institution holds that municipal building activities should be controlled by the municipal engineer. Naturally Mr. Howitt is against this, considering that the municipal architect should be the leader. Rather haughtily, but with some justification, Mr. Howitt says:—

> "Unlike 'architect,' which has a statutory significance, 'engineer' can be applied to the designer of some mammoth civil engineering undertaking or to the man who oils the engine on a local ferry boat and it is wise and usual to include a qualifying prefix."

But even with a prefix the term "engineer" is freely adopted by, or applied to, the unqualified. That is why many people advocate the placing of engineers on some such basis as that which architects enjoy.

The Silicon - Controlled Rectifier

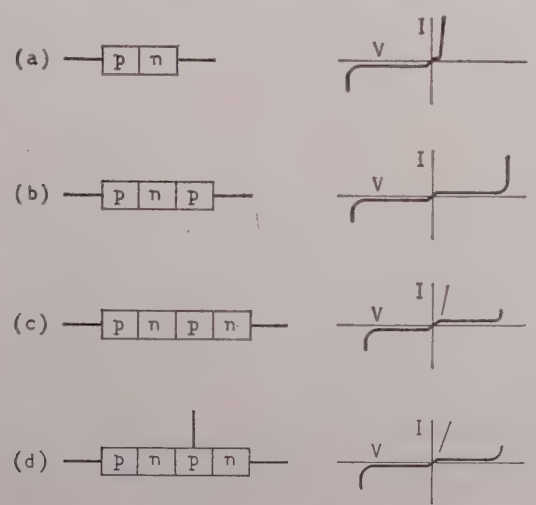
This article is one of a series based on lectures given at the last A.E.I. summer school for professors of electrical engineering, held at Rugby in July, 1960. The author discusses the theory, design, manufacture and characteristics of the controlled rectifier, which is the solid state equivalent of the gas thyratron

By A. E. GARSIDE
B.Sc., Graduate I.E.E.*

A NEW semiconductor device which has been called the "controlled rectifier" has recently received much publicity. It is the solid state equivalent of the gas thyratron, though not a plug-in replacement, and has the ability to block voltage in both the forward and reverse directions and to switch large currents by small changes in control circuit current. Once the grid in the thyratron has allowed a discharge to commence it cannot regain control whilst a positive voltage remains on the anode. The trigger electrode in the controlled rectifier functions in a similar manner to the thyratron grid. In principle, the controlled rectifier operates in the same way as a thyratron in circuits such as phase-controlled a.c. switches, reversing drives, invertors, etc.

Before discussing the theory of operation of the rectifier and p-n junctions it is necessary to define these terms. Silicon is a four-valent element. If impurities in the form of five-valent elements are added they do not fit perfectly into the structure and result in an excess of electrons. Silicon containing these impurities, e.g. arsenic, antimony, etc., is known as "n" type. Similarly, if three-valent impurities are included in the structure, these produce a deficit of electrons, called "holes," and this is known as "p" type silicon. Gallium, indium, etc., can be used to produce this. A transition from "n" type to "p" type material in a bar of semiconductor produces a p-n junction.

Fig. 1.—Voltage/current characteristics of various p-n structures



A diagram of a p-n junction and the V-I characteristic, which is easily recognised as that of a rectifier, is shown in Fig. 1a. The addition of a "p" layer to this structure (Fig. 1b) produces a form which is now familiar as a transistor. Its two-terminal V-I characteristic shows that this device is capable of blocking voltage in both the positive and negative directions. Progressing to Fig. 1c a further layer and junction is added which results in a two-terminal switch. Fig. 1d is a three-terminal version of this and is the form the controlled rectifier takes.

To examine its operation the p-n-p-n structure may be considered as two transistors with a common collector junction j as in Fig. 2. The fraction of the hole current, injected from the emitter of the p-n-p transistor, which

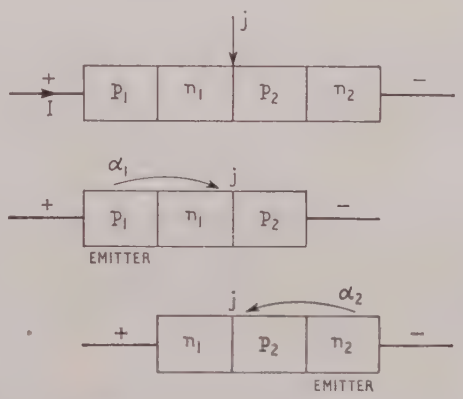


Fig. 2.—Transistor representation of the p-n-p-n structure

reaches the collector junction j, is called α_1. Similarly, the fraction of the electron current, injected from the emitter of the n-p-n structure reaching the collector junction, again j, is α_2. The total current I, flowing through the junction j, is made up of three components: $I\alpha_1$, the hole current from the outer "p" region; $I\alpha_2$, the electron current from the outer "n" region; and Ico, the total saturation current across j. This relationship may be written $I = \frac{Ico}{1-\alpha_1-\alpha_2}$. If α_1 and α_2 are very small then the

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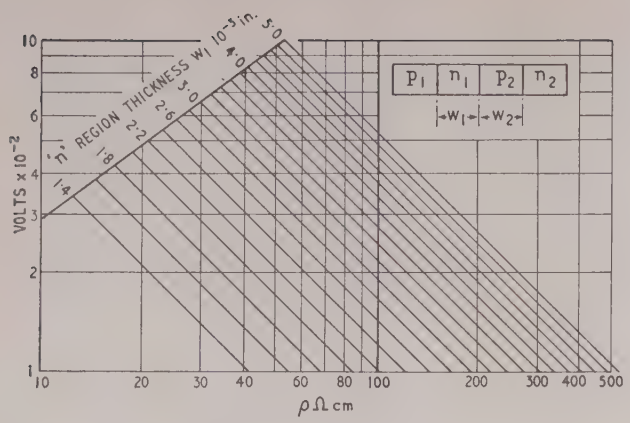


Fig. 3.—Effect on voltage of varying the base region thickness for various silicon resistivities

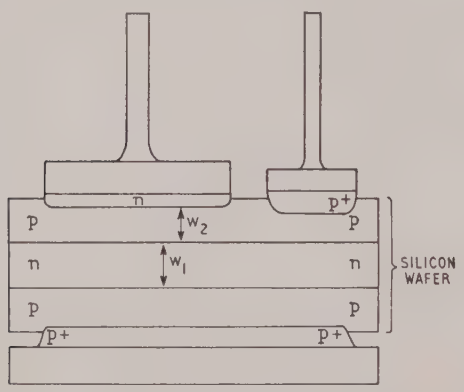


Fig. 4.—An alloy-diffused p-n-p-n structure

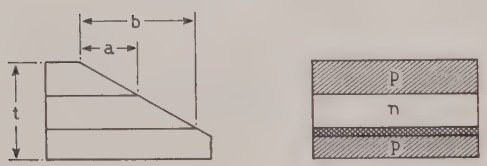


Fig. 5.—Ground and stained diffused silicon slice

current in the circuit will be very small, Ico in a silicon device being very low. This corresponds to the " off " condition of the device. If, however, $(\alpha_1+\alpha_2)$ can be made to approach unity then the value of I becomes large and in practice would be limited by the external circuit. This corresponds to the " on " condition.

One method which can lead to the increase in the values of α_1 and α_2 is the current multiplication phenomenon. If the reverse voltage applied to junction j is increased until appreciable multiplication of carriers occurs in the space charge region associated with the junction, the values of α_1 and α_2 will be increased by the multiplication factors m_1 and m_2 respectively. This is termed multiplication switching and the voltage at which it occurs is the breakover voltage.

An alternative method of increasing the values of α_1 and α_2 is to inject current into the device by a third terminal called the trigger electrode. Because the α values increase as the emitter current increases, as seen in silicon transistors, the switching action can be obtained.

The device will remain in the " on " state provided the

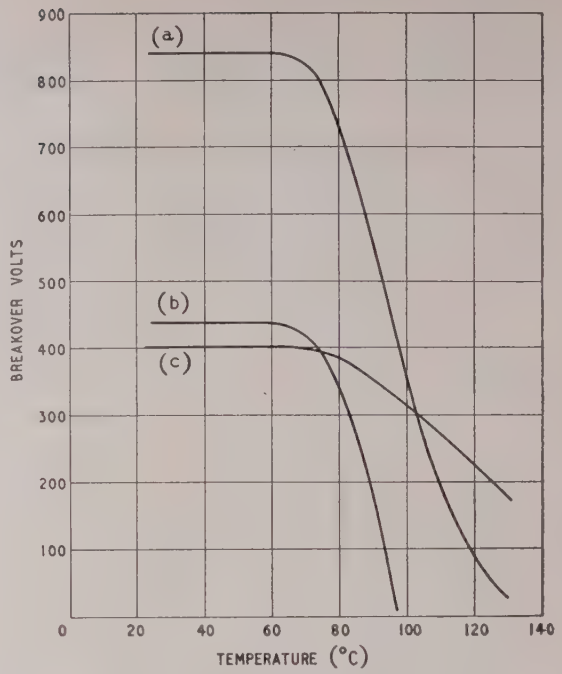


Fig. 6.—Breakover voltage variation with temperature

current through the device exceeds a minimum value termed the " holding-in " current. A reduction of current below this value will result in the device reverting to the blocking condition. It should be noted at this point that the controlled rectifier is a current-triggered device and hence a low impedance trigger source is required. To make the control of the α values easier, a relatively thick base region is used compared with those of transistor structures where high values of α are required. Another extremely important function of the thick base region is that it allows a higher-voltage device to be produced.

Design Considerations

The effect on voltage obtained by varying the base region thickness for various resistivities of silicon is illustrated in Fig. 3. From this it can be seen that although the avalanche breakdown voltage increases with increasing resistivity, unless the base layer thickness w_1 is sufficient, a lower voltage than that predicted by avalanche breakdown theory can be obtained due to " punch-through " effect. It is therefore obvious that the control of the base layer thickness, w_1 in Fig. 4, is very important. The control of thickness w_2 is also necessary as this determines one of the α values. If this region is too narrow then the combined α becomes too high and a " permanently switched " structure is obtained having the characteristic of a rectifier, as in Fig. 1a. Conversely, too thick a region can make the structure difficult to switch.

The main junction area must be sufficiently large to give the desired forward characteristic when in the " on " state so that the internal power loss is not excessive at the required current output of the device. The geometry of the trigger electrode must be so arranged that the desired trigger characteristics are obtained. The main point of note here is that the action takes place initially from a point, and the trigger electrode should therefore be small. It should be placed close to the main electrode

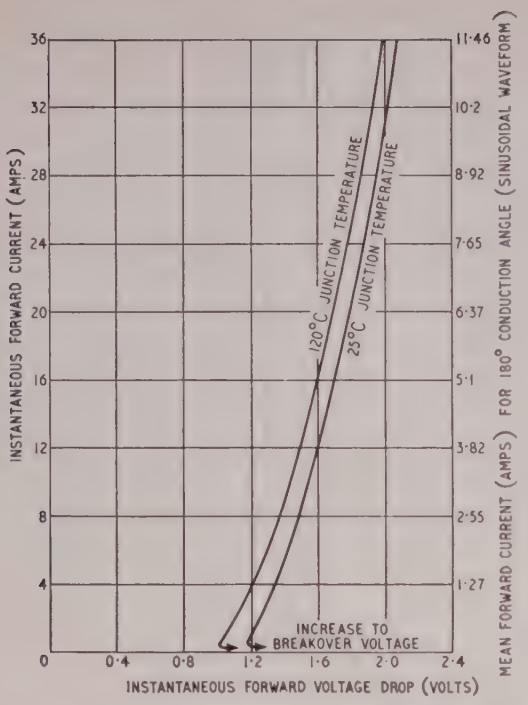


Fig. 7.—Forward characteristic in the conducting state

to reduce the trigger voltage and to concentrate the current flow.

Method of Manufacture

There are various methods of making the desired p-n-p-n structure, such as double alloying, double diffusion, and alloy diffusion. A structure of the last-named form is shown in Fig. 4. The starting silicon is single-crystal "n" type of a resistivity range such that high-voltage units may be obtained, see Fig. 3. These billets of silicon are sliced, lapped precisely to within ±0·0001in and then chemically etched and washed to produce a clean polished surface. The diffusion operation is then performed on these slices, consisting of heating a "p" type source until it vaporises. The vapour will diffuse into the "n" type slices forming a p-n-p structure. As this operation is both time and temperature dependent, both of these parameters have to be closely controlled to produce the desired residual "n" region thickness. A typical cycle for a gallium, "p" type, source would be 65 hr at 1,250°C. Because of the long time at such a high temperature meticulous care must be taken over all cleaning operations prior to this process to minimise contamination.

The depth of diffusion is then checked. Part of one of the slices is ground at an angle and the "p" regions are stained as shown in Fig. 5. By measuring the thickness of the slice t and the distances of a and b, the depth of penetration can be calculated. The remainder of the slices are cut into pellets of the desired size, and the operation of forming an alloyed "n" region on one of the "p" layers completes the structure. It is often convenient to attach the trigger, cathode and anode electrode simultaneously with this operation, but this depends on the design of the device. The final stages in the manufacturing operation are to mount the element on a suitable base, e.g. copper stud, and to encapsulate it to produce a hermetically sealed device.

Characteristics

The reverse characteristic of the device under normal conditions is the same as that for a semiconductor rectifier, the reverse current increasing as the temperature increases. It is necessary to avoid voltage spikes in excess of the specified peak reverse voltage, as these may cause failure, and to limit the junction temperature to avoid thermal instability. The forward characteristic may, however, necessitate a value of junction temperature much lower than that required by the reverse characteristic. This is illustrated by Fig. 6, which shows three cases of the variation of the breakover voltage with temperature. It can be seen that the breakover voltage after remaining approximately constant falls rapidly due to the change in value of the α's of the junctions. It is important that the "knee" should occur at as high a temperature as possible so that the maximum breakover voltage can be used without reducing the current rating of the device. It would be rather hazardous to operate devices (a) and (b) at high voltages at temperatures beyond the "knee" because of the rapid change of breakover voltage with small changes in temperature. Device (c) is much more stable in this respect.

The forward characteristic in the conducting state is shown in Fig. 7 for a 10 A unit. This is similar to the forward characteristic of a p-n rectifier though the voltage drop is higher than for rectifiers having the same junction area. The instantaneous trigger current and voltage

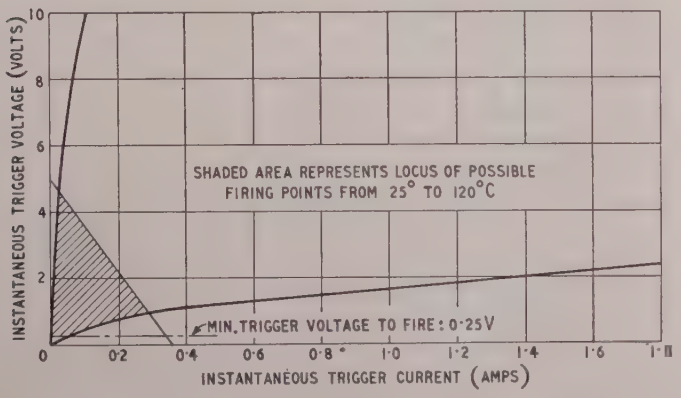


Fig. 8.—Trigger characteristics for junction temperature from 25 to 120°C

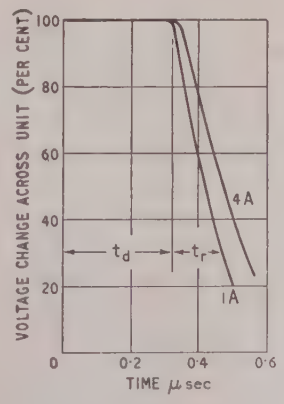


Fig. 9.—Turn-on characteristic

required to fire a controlled rectifier are temperature dependent, the instantaneous trigger current and voltage needed decreasing with increase of junction temperature. Fig. 8 shows the trigger characteristics. The test limits are set so that all acceptable devices will fire inside the shaded area (over the temperature range 25°C to 120°C). The trigger circuit should be designed to operate outside this region but not so far outside that the trigger power limits are exceeded, e.g. for 10 per cent duty cycle 5 W.

Switching Characteristics

A turn-on characteristic is shown in Fig. 9 and it can be seen that there is a slight delay, t_d, before the unit begins to conduct load current. This delay time can be altered by changing the magnitude of the triggering pulse, the time decreasing as the pulse is increased. The rise time of the device, t_r, decreases as the voltage is increased or as the load current is reduced. In operation the rise time of the load current will be dependent primarily on the nature of the load.

The anode voltage must be reduced to zero so that the device may be turned off and the trigger regain control. The time, t_o, required for control to be re-established is dependent on both device and circuit conditions. Parameters affecting this are the junction temperature (t_o increases as the junction temperature increases); the reverse voltage (t_o decreases as the reverse voltage

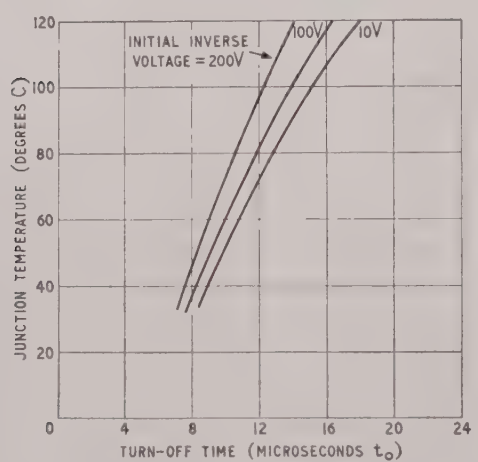


Fig. 10.—Turn-off time varies with junction temperature and reverse voltage

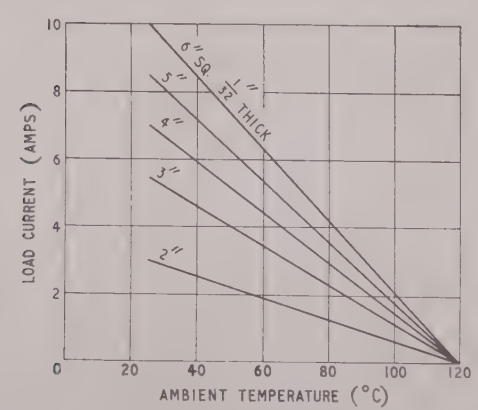


Fig. 11.—Rating characteristics for various sizes of cooling fins

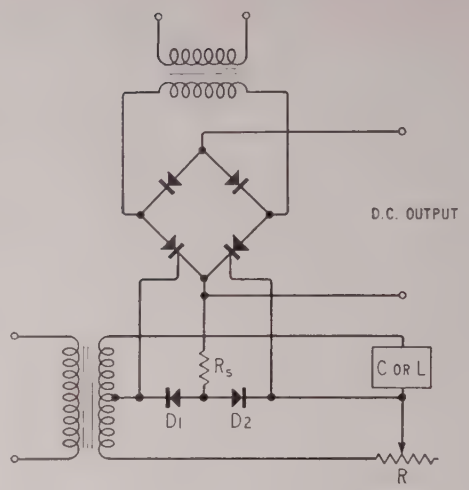


Fig. 12.—Full wave phase controlled rectifier

increases); and the load current (t_o increases as the load current increases). Fig. 10 illustrates the variation of turn-off time with junction temperature for various reverse voltages.

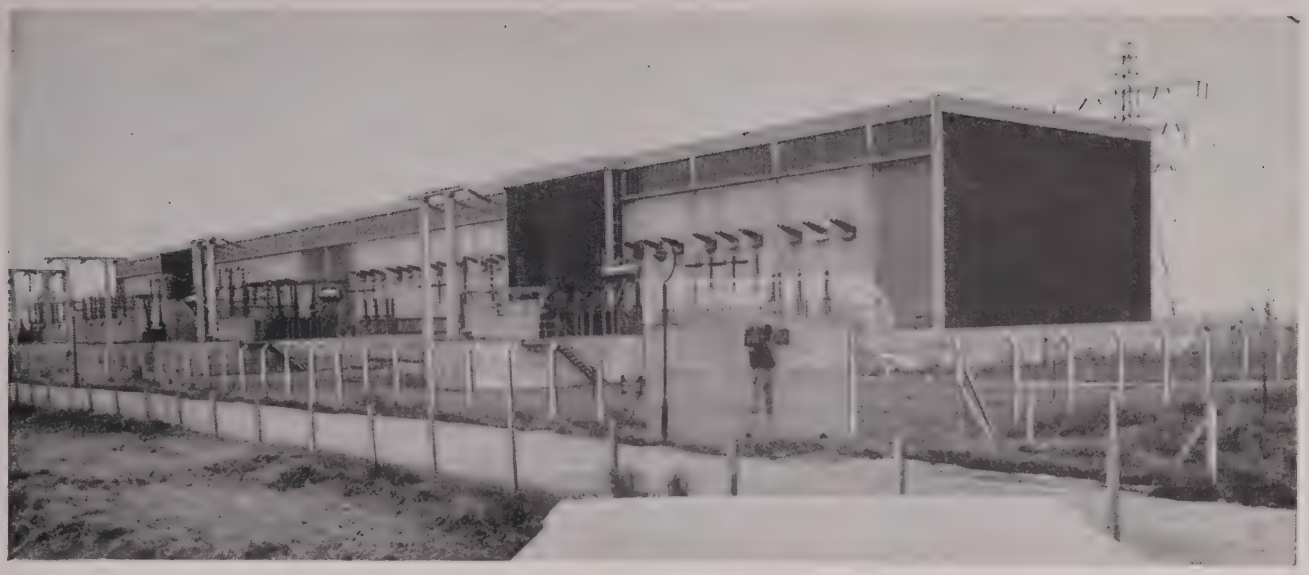
Current Rating

The first consideration in obtaining a rating for the controlled rectifier, as with any semiconductor rectifier, is the maximum junction temperature. At the present moment this is limited by the forward breakover characteristic to about 120-150°C (see Fig. 3). In addition, the forward characteristic and the thermal resistance from the junction to cell base must be known. It is essential that the complete system of device and heat sink be capable of dissipating the internal power loss of the cell without the maximum junction temperature being exceeded. In Fig. 11 the maximum forward current against ambient temperature for various sizes of cooling fins is shown for a 10 A unit. The fins are $\frac{1}{32}$in thick copper and mounted vertically with free convection cooling.

Applications

A simple full wave phase controlled rectifier circuit of a type often used with thyratrons is shown in Fig. 12. The phase shift to delay the trigger signal with respect to the anode voltage is provided by the R-C or R-L network. The rectifiers D_1 and D_2 prevent reverse voltage being applied between the cathode and the trigger during the reverse half-cycle. The resistance R_s is the trigger supply load resistor. More precise firing of controlled rectifiers can be obtained, however, if a steeper wave front than that obtained from 50 c/s a.c. is used.

Summing up, the controlled rectifier possesses several features which therefore make it very attractive. It has a low volt drop (1-2 V) in the conducting state; no filament, which eliminates transformer windings and gives instant operation; small size and robustness; fast switch-on time; and fast recovery time—an order of magnitude better than the thyratron valve. There is no doubt that this device will replace thyratron valves in many applications purely on efficiency and size. There is, however, the problem of obtaining high voltages and the high-voltage gas-filled valve has a distinct advantage in this field.



BELVEDERE SWITCHING STATION

Hall Type Substation for 132 kV Switchgear

A DESCRIPTION of the generating station under construction for the Central Electricity Generating Board at Belvedere, near Erith, Kent, was published in last week's issue. Designed for an ultimate installed capacity of 480 MW, the station will have four 60 MW and two 120 MW oil fired boiler/turbo-generator units. The generators are synchronised directly to the 132 kV transmission system at an adjacent switching station. Control of the generator units is carried out from unit operating stations within the power station, containing both boiler and turbine control panels, while synchronising, switchgear control and station loading are catered for in the central control room.

The switching station site was subjected to flooding in 1953 with a standing flood level of +7·3 O.D. and the station, with the 132 kV switchgear installation, has been designed so that no equipment is accommodated below +7·5 O.D. with additional flood protection to +12·0 O.D. To obtain the requisite flood protection and allow for normal operating conditions, the whole of the switchgear floor area had to be raised to +7·5 O.D. (6ft above the average ruling ground level) and a perimeter wall to +12·0 O.D. had to be provided. The decision to accommodate the 132 kV switchgear in a building was made largely for this reason.

The design of the building permits all columns and beams of the reinforced concrete frame to be used as switchgear mounting structures, and lightweight cladding of aluminium backed by rock wool and asbestos board has been used for the walls and roof to achieve the maximum economy in building costs. The main building is 600ft long, 80ft wide and rises to 55ft above ground level, the approximate volume being 2·5 million cu ft. At floor level there is a stores and workshop at one side of the centre bus section and on the other side there are battery and auxiliary rooms. On the first floor a suite of offices has been provided including a dark room with full facilities for film developing for circuit-breaker timing tests. A hand-dressed mimic diagram has been installed to provide the operating personnel with a complete picture of switching conditions, as the control room is remote from the switchhouse.

The switchhouse is some 600 yd from the power station, and in view of the marshy nature of the ground, a cable tunnel has been installed to provide support and protection for the interconnecting cables. The switching station site accommodates four double circuit overhead line terminal towers on the west side and the 132/3·3 kV 7·5 MVA station transformers and three 90 MVA 132 kV busbar reactors on the east.

General Arrangement

The switchgear is arranged in four sections, each having main and reserve busbars. The busbar sections are accommodated within separate halls, full segregation being provided at each bus section breaker bay. The busbars run longitudinally with two separate circuits connected back-to-back in each bay, an arrangement used to reduce the overall length of the installation. All feeders and bus coupler circuits are on the west side, and all generator, station transformer and busbar reactor circuits are on the east. The switchgear installation was carried out by the English Electric Co., Ltd., and embodies their standard type OBN9G outdoor air-blast circuit-breaker having a rupturing capacity of 3,500 MVA. Clearances of 5ft 3in phase to phase and 4ft 2in phase to earth have been allowed for an impulse withstand of 650 kV.

All circuit terminations are made outside the switchgear halls, connection to the switchgear being via through-

wall bushings which also provide accommodation for current transformers. Capacitor type voltage transformers are provided for synchronising and instrument purposes on all generator and feeder equipments and are also accommodated outside the main halls, adjacent to the circuit terminations. Relay and compressor rooms have been provided within the building space available at two of the bus section bays, the space at bus section 2 providing battery and l.v. a.c. switchboard accommodation, offices, stores, workshops, etc.

The busbars are 3in o.d. copper tube having a wall thickness of 16 s.w.g. and a current rating of 1,200 A. The nominal section is 0·59 sq in, with an electrical resistance of 0·014 Ω/1,000ft at 16°C and a weight of 2·28 lb/ft run.

Connections from the busbars to the circuits are 2in o.d. copper tube, having a wall thickness of 14 s.w.g. with a current rating of 800 A. The nominal section is 0·48 sq in, with an electrical resistance of 0·017 Ω/1,000ft at 16°C and a weight of 1·86 lb/ft run. Connections are also run where possible using flexible conductor of the Holtum type: 1·0in diameter for 800 A rating and 1·19in diameter for 1,200 A rating.

The busbars are suspended from the main building roof beam by Bullers porcelain insulators, of the Lapp type, at 6ft 6in centres between phases. The insulators are of two-unit construction, the complete assembly weighing 214 lb. As this is an indoor installation the total creepage distance for these insulators is only 80 per cent of that normally required for 132 kV insulators, while the minimum flashover voltage is 445 kV dry, 750 kV impulse and 135 kV corona against standard minimum outdoor values of 355 kV, 650 kV and 105 kV respectively.

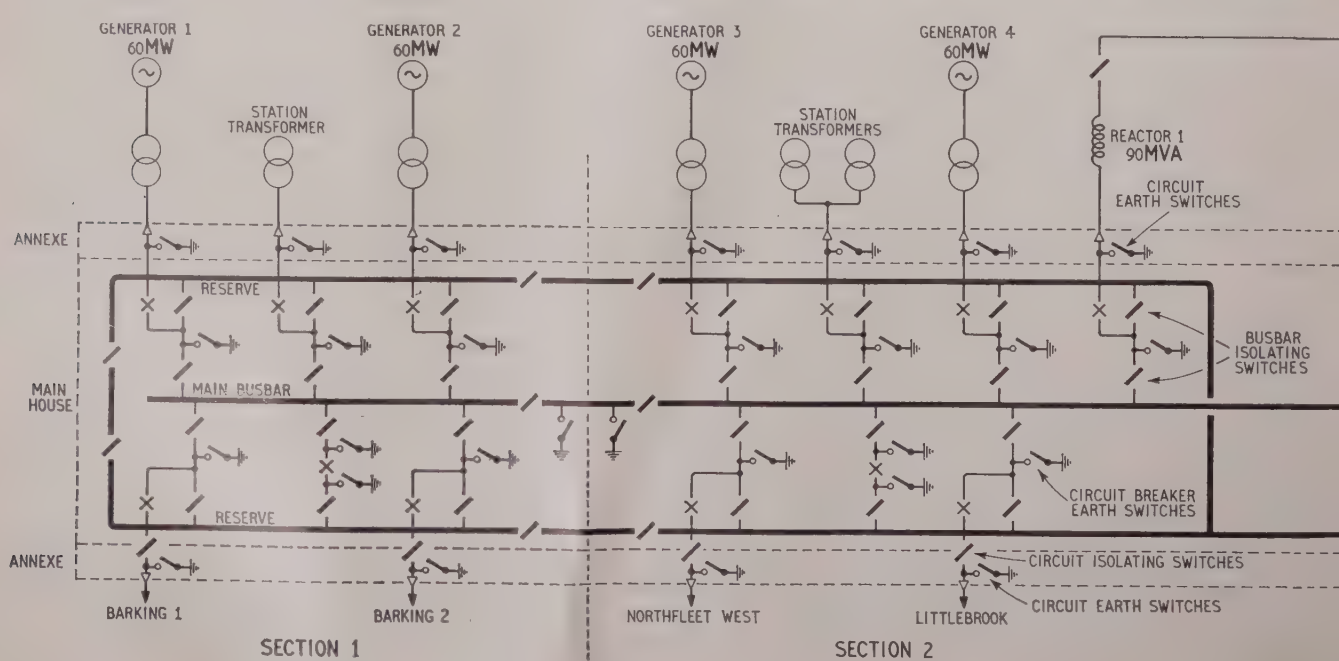
Isolating Switches

The busbar isolating switches are of the rotating centre post pattern with vertically mounted bases. Those associated with all circuits have a current carrying capacity of 800 A and those used for busbar coupling and sectionising are rated at 1,200 A. The maximum short time current rating of all isolators is 15·3 kA r.m.s. for 3 sec. The operating mechanism was specially developed. A single horizontal interphase drive rod is used, mounted outside the line of the isolator base and connected through a crank lever to push and pull vertical rods from the mechanism box at floor level. The operating handle sweeps through a vertical movement greater than 180° to allow for over toggle locking in both open and closed positions. The isolator phases are mounted at 8ft centres and have a minimum total air gap between poles of one phase of 7oin, the fixed posts being at 7ft centres.

A remotely operated earthing switch is fitted to the circuit-breaker side of the main busbar isolating switch, to provide an earth point between breaker and busbar for maintenance purposes. This takes the form of a horizontal arm mounted on a bearing bracket on the isolator base connected by flexible braids to the main station earth bar. When closed the arm engages with a contact mounted at the side of the isolator head. The operating mechanism is fitted with an electrical bolt interlock with emergency release device and with Castell lock type mechanical interlocks. Auxiliary switches for interlock control circuits, busbar protection and indication facilities are fitted to the mechanisms. The auxiliary switches are of the rotating drum pattern, the drum being driven directly from the main operating levers.

The line isolating switches are similar to the busbar switches but are all of 800 A rating and use the through-wall bushing to provide the support for one fixed contact. In view of this the isolator base mounts only one fixed post and the rotating post with drive mechanism, and very rigid supports are required for the base to prevent the arm binding in the contact heads, as the torsional forces tend to distort the mountings. The line earthing switch closes over the outdoor end of the through bushing, the associated operating mechanism being mounted inside the switchhouse.

In accordance with current practice, no by-pass isolators are installed but provision has been made for flexible conductor connectors to be fitted to the line side of the isolating switch for direct connection to the reserve busbar as an emergency measure. The through-wall bushings



are manufactured by the Bushing Co., Ltd., and are of oil-filled synthetic resin bonded paper condenser pattern. The inner and outer ends of the bushing are treated as separate oil sections each fitted with a conservator and gauge glass, the total oil volume being 7½ gallons. The mounting turret is also used to accommodate current transformers of standard bushing pattern and the condenser foil earth lead is brought through to an external earth stud to give availability for testing. No built-in facility for on-load power-factor testing of the bushings has been provided, as it was not considered necessary to incur the additional cost in view of the infrequency of the tests.

Circuit-Breakers

The air blast circuit-breakers have a full load current rating of 800 or 1,200 A, according to circuit requirements. Each phase unit is fitted with three blastheads in series, provided with resistors to control the voltage distribution between each end and to limit the rate of rise of restriking voltage. The blastheads are fitted with single flow axial blast butt contacts having a 1¼in long stroke, and a separate series isolator with a length of break of 50in is incorporated with each phase unit. Operation is controlled by electrically operated pneumatic valves releasing air at 310 p.s.i. from the unit receivers. Each breaker is provided with a local control cabinet in which all air control valves are situated with low air lock out and alarm switches and a local control switch. To ensure dry insulation within the breaker porcelains, a system of circulating air is provided which requires 9 cu ft of free air per hour.

Compressed Air Equipment

There are two compressor rooms within the switchhouse arranged so that under normal conditions each provides air for half the station. Coupling is allowed in both the h.p. and l.p. systems to cover the possibility of one or more compressors being out of service. Each room accommodates three electrically driven three-stage air-cooled compressor units supplying 30 cu ft/min of air at 600 p.s.i. through a common bus pipe to storage receivers placed outside the room. The receivers for each room have a capacity of 7,200 cu ft, sufficient for 15 make/break operations. This is in addition to the storage at each breaker which is sufficient for 2 make/break operations. From the storage receiver air is fed via a master shut down valve to the reducing valve, to supply the operating ring main at 310 p.s.i. Each compressor is driven at 700 r.p.m. through vee-belts by a 20 h.p. 1,440 r.p.m. motor. The air system for the station is such that the minimum interval between make/break operations that can be maintained with all compressors running is 1¾ min.

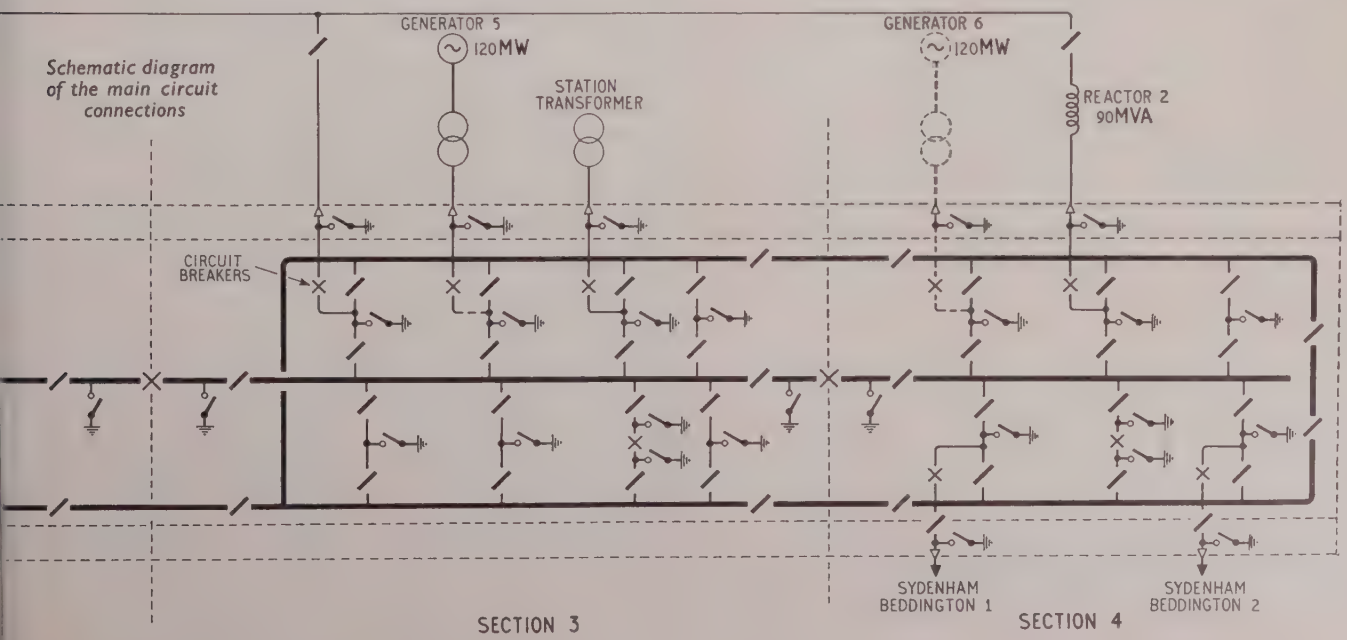
An electrical control scheme gives sequential control of compressor starting, allowing a two minute delay between the starting of the three compressors. Incorporated in the scheme are counters to record the number of operations of each compressor and also the total hours' running of each.

Circuit Connections

Circuits are connected to the switchgear either directly from overhead lines or by cable, but all terminations are external to the switchgear halls, being accommodated on the building annexe. Facilities are made at each feeder bay for overhead line down lead anchorage to the wall of the building and these are at present used with two circuits. Cable tunnels have been provided beneath each annexe to facilitate cable entry, required in the case of four feeder circuits from the overhead line terminal towers and all generator circuits.

The 132 kV three-core impregnated gas pressure cables, supplied by British Insulated Callender's Cables, Ltd., have a normal operating pressure of 200 p.s.i. and each core is divided out to form the terminating tail, avoiding trifurcating. The 132 kV connections to the station transformers and busbar reactors are made by overhead conductors, spanning the site access road.

All generator and feeder equipments are fitted with a single-phase voltage transformer for synchronising and instrument supplies. The voltage transformers are of the oil-filled capacitor type with the compensating magnetic winding being self-contained in the base of the capacitor.





A general view in Section 3

The whole unit is mounted on the building annexe and connected to the line termination.

Control

The switchgear is controlled from a central room in the generating station, where a comprehensive panel is provided for the switchgear and a desk for generator control. In view of the distance involved, the control panel operates at 50 V d.c. with interposing relays installed at the switchgear end. The cabling between the two points is carried out in dry-core type telephone cables terminating in main junction cubicles, one for each section of switchgear. The trunk cables are so arranged that any one of four may be lost through fault, and after reconnection in the main cubicle there are sufficient spare cores available in the other cables to take over the functions that would otherwise be lost.

Switchgear Access

In this installation access is required at four levels, busbar level, isolating switch level, floor level and basement level. At the busbar level a set of runway beams have been installed with each section of busbars from which a travelling trolley is suspended. The trolley is designed to allow support insulator cleaning and, by let-down side flaps, the replacement of damaged units. All trolley runways are covered by gates which are locked and controlled by the Castell key type interlocking associated with the busbars.

Most busbar isolators are mounted on concrete platforms which form continuous walkways along the length of any switchgear section and from which access can be obtained at this level. Screen-work ensures that these walkways form safe passages at any time. Lowering platforms or bascules have been provided adjacent to each busbar isolating switch to provide a working platform for normal maintenance work. The bascules are normally locked in the closed position, interlocked so that they may be lowered only with the busbar and associated circuit-breaker earthed. Conversely the bascule must be in the closed position before the circuit can be restored to service. For isolators mounted on the walls no built-in maintenance platform has been provided, as no safety clearance is required to be maintained to backing circuits. A lightweight portable scaffolding is used to erect a platform as required.

At floor level steel mesh fabric has been used to form screens around each circuit-breaker and this forms three walkways along the length of the switch halls, one adjacent to each outside wall and one through the centre of the hall. These passages are safe access ways at all times and have been used to accommodate the various operating mechanisms. All line isolating switch and earth switch mechanisms are mounted along the wall passage and the busbar isolating switch and earthing switch mechanism are mounted along the centre passage. The circuit-breaker local control cabinets also face the centre passage.

Each circuit-breaker bay has an entrance gate from the centre walkway, controlled by Castell interlocks to ensure that the circuit is isolated and earthed before entry can be made, and conversely is locked closed before the circuit can be restored.

The basements form four longitudinal tunnels with transverse connections at each end of the building and at each section bay. Access to the basements is given by a staircase at the centre section and emergency manholes are fitted in section halls and in each compressor room. In view of the closed nature of the basements a watertight bulkhead has been fitted at the corners of the building to allow entry for cable pulling from drums mounted externally.

Electrical Supplies

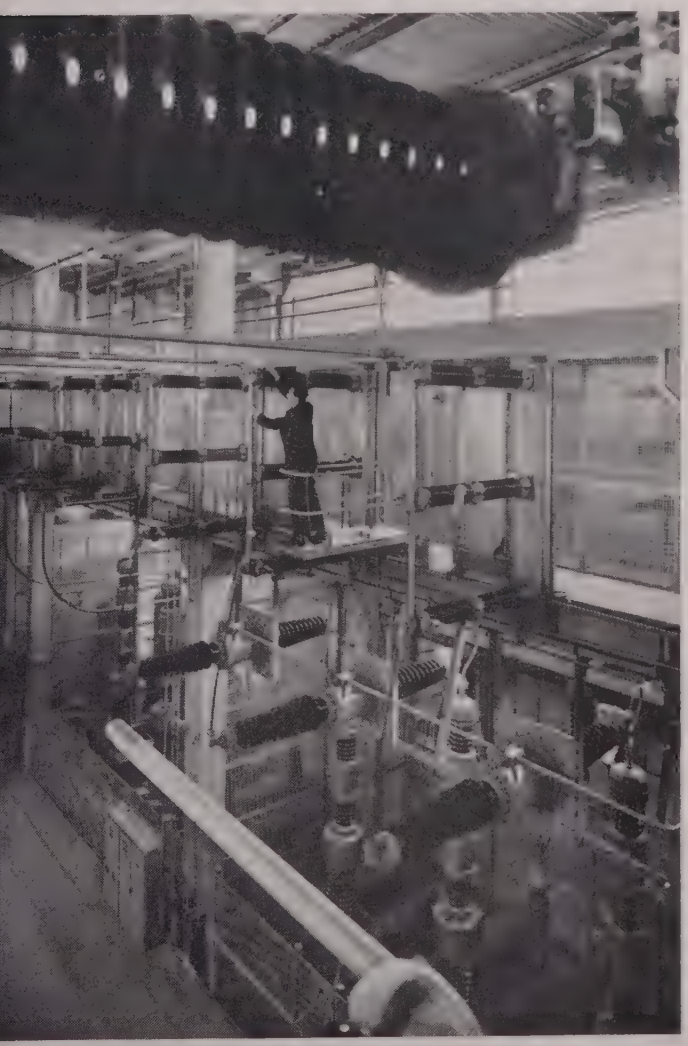
The control scheme operates at 50 V d.c., and obtains a supply from a 300 Ah battery in the power station. The 110 V 250 Ah battery for switchgear operation is installed in a battery room in the centre section of the switchhouse. Access to the room is from outside the building to prevent acid fumes entering the switch halls. The battery connections pass through the wall to the auxiliaries room within the switchhouse for connection to the control panel. This panel forms part of a suite comprising the constant voltage charger of Standard Telephones & Cables, Ltd., manufacture and the battery control and battery distribution panels. The charger has a 3·5 A trickle rate with a 35 A boost rate. Emergency lighting for personnel access only is installed in the switchhouse and supplies are taken from this battery.

Two 300 kVA auxiliary transformers are installed to provide a.c. supplies, each directly connected to a station transformer and feeding an individual switchboard. The

boards are arranged to stand by to each other in the event of transformer failure.

Circuit Protection

Four feeder circuits are each fitted with Reyrolle split pilot protection employing pilot cable cores to obtain matching conditions between each end of the circuit. These feeders before being turned in to Belvedere were directly connected between Barking and Littlebrook and fitted with split pilot protection, so the addition of equipment at Belvedere avoided changes at the existing terminals. The two Sydenham feeders are fitted with Solkor pilot wire protection with surge-proof inter-tripping from the transformers at Sydenham. The generator circuits are fitted with a biased overall protection of A.E.I. design covering the two transformer windings and the generator winding. In conjunction with this a h.v. balanced earth fault protection is fitted to the 132 kV winding of the step-up transformer. Also a generator neutral earth fault protection is provided for the 11 kV connections. The machine rotor is further protected by negative phase sequence protection with c.t.'s mounted in the machine pit. Back-up protection is provided by inverse definite minimum time overload protection, and transformer Buchholz and winding temperature protection.



Maintaining a busbar isolating switch on a bus-coupler circuit. The bus-coupler circuit-breaker is installed in the bay at ground level

The unit transformer directly coupled to the generator connections is also provided with overall protection, overcurrent, Buchholz and winding temperature protection. Mechanical protective devices are fitted to the turbine, the oil feed, and the circulating water systems which automatically trip the electrical equipment.

The station transformers are protected by balanced earth fault gear on both the h.v. and l.v. windings with Buchholz, winding temperature and overcurrent protection. The primary plant arrangement allows for two station transformers to be connected to one 132 kV circuit-breaker and in this case the h.v. earth fault protection covers both transformers, but each is fitted with a further set of balanced earth fault gear arranged to give indication of the faulty transformer.

Bus couplers and bus section equipments are fitted with overcurrent protection, no provision being made on the couplers for by-pass conditions, as if the emergency by-pass arrangements are used the circuit current transformers remain in service in view of their mounting position. Links are provided in the tripping circuits to allow transfer of tripping to the coupler circuit-breaker. A comprehensive system of circulating current protection is provided for the busbars, the main zones of which are discriminated to the busbar sections and a check zone is installed which covers each half of the installation. Both phase and earth fault conditions are covered, zone coupling at sections being carried out by contactors operated by the respective isolating switches.

Metering

Standard tariff metering equipment is fitted for both kWh and kVAh on all generators, unit and station transformers. Summation equipment is provided for generators and station supplies, the equipment being duplicated as the station busbars can be divided between the Thames North and Thames South control centres. To assist the area control engineer, feeder flow metering is provided on all feeder equipments with overload alarm on selected feeders arranged to transmit to the respective area control centres.

Acknowledgment is due to Mr. H. J. Bennett, Director of the Eastern, London and South Eastern Region of the Central Electricity Generating Board, for permission to publish this article.

First 120 MW Set at Belvedere

In last week's issue it was stated that the first of the two 120 MW turbo-generator/boiler units at Belvedere power station had just been put into service. The set is not, in fact, yet in commission but is expected to be put into service early this year.

Transformer Impulse Test Currents

In E.R.A. report S/T97 "Line and Neutral Currents in Multi-Limb Transformers under Impulse-Test Conditions," by E. L. White, price 15s, terminal currents in two-limb and three-limb transformers under impulse test are analysed with a view to selecting the most suitable current to record for fault detection and location. Proposed new recording circuits are shown by tests on a two-limb transformer to have high sensitivity to faults, though the location of faults from the line current remains unreliable.

High-Speed Brushless Alternator

By F. J. ALLEN*

Test Results of a Preliminary Build

The design and construction of an alternator employing a stationary armature core made from strip magnetic material coiled up in a roll is described. A solid hub, which rotates inside the armature, carries the pole pieces which register with the core on both sides, making axial instead of radial air gaps. Results of tests on a prototype show that this machine can operate at up to 30,000 r.p.m.

THE development of high-speed mechanical apparatus has created a need for electromagnetic machines of comparable performance, a typical example being generators which can be coupled direct to gas turbines. The orthodox heteropolar machine provides the best solution at normal speeds, but most schemes designed for high-speed or for high-frequency operation, or to avoid the use of brushes, seem to incur some penalising complication in the basic electromagnetic action. However, most machines hitherto developed for these applications have confined themselves to a feature of construction common to the older designs evolved for more ordinary purposes, namely, that of plane laminations placed normal to the axis of rotation. By resorting to a different arrangement, it is possible to simulate the ideal of a standard type of alternator running at a speed far beyond that which it could ordinarily withstand.

The arrangement which fulfils this case was described in a letter to the *Electrical Review* of 8th May, 1959. Essentially, the armature core is made from strip magnetic material coiled up like a roll of tape, slotted radially on both sides to receive the armature winding which may be of the simple toroidal type or any of the known surface types as will be seen later. There is a cylindrical hub within the armature surrounded by a stationary coil which magnetises it axially, and it carries end cheeks milled with spoke-like projections forming the poles. These register with the two sides of the core forming the normal air gaps except that they are axial instead of radial. The sign of all poles at one end of the hub is the same and opposite to that of those at the other, but the normal assembly would be with poles of alternate sign equally spaced angularly.

This hub and pole assembly (two pieces only as a rule) is of solid steel and is the only moving part of the machine. Moreover, it can be designed to approach the mechanical ideal of developing only well-distributed tensile stresses compatibly with its magnetic functions. Thus pole tip velocities of 1,000ft/sec or more should be perfectly practicable. This construction was covered by Patent Specification 628,018 dated March, 1947, which, however, has not been kept in force, but a special adaptation covered by Specification 805,352 of March, 1955, is still current.

The main features of a machine built to study the possibilities of fulfilling a certain specialised duty are shown in Fig. 1. It was designed entirely from first principles without reference to any existing model. Unfortunately, the situation in which it had to operate imposed some restrictions on what could be done. For instance, the available flux was limited by a rather large bore through the hub. Again the normal full-speed requirement was limited to 15,000 r.p.m. giving a pole tip velocity of only 507ft/sec, a value which could easily be

* Rolls-Royce, Ltd., Derby.

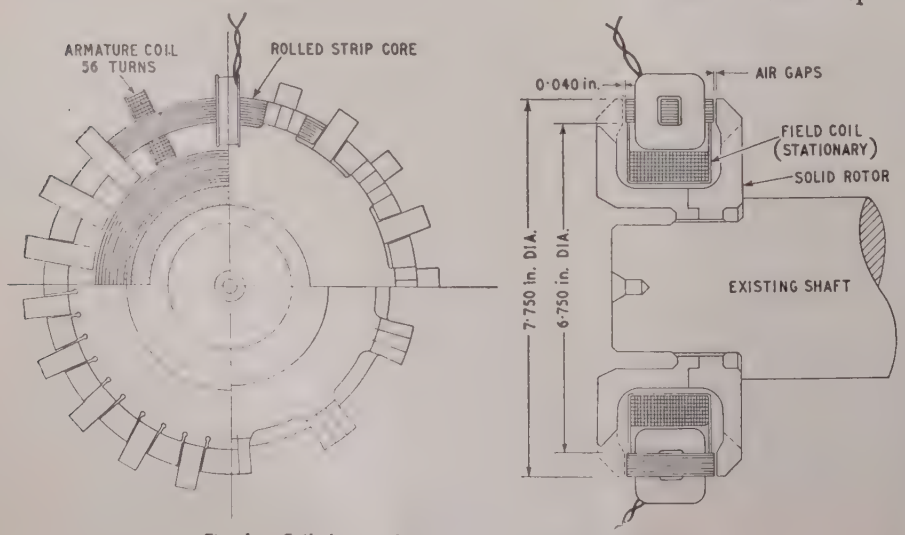


Fig. 1.—Coiled-core alternator for a special application

doubled without undue stress. With 20 poles, the frequency was thus 2,500 c/s. Thirdly, it is essentially a single-phase machine which, in principle, is capable of only half the duty of an equivalent polyphase machine. In actual fact, owing to the special requirements, each of the 20 armature coils fed a separate circuit and differed in phase from its neighbour progressively round the armature. This meant that one tooth on each side was wider than the rest as can be seen from Fig. 2 (a).

The strip was coiled up so that the two ends overlapped sufficiently for a pair of insulated rivets to be put through radially to hold them. But an adhesive (Redux) was also applied during coiling to help in imparting ridigity and a pressure roller kept in contact throughout. This resulted in the teeth taking a slight outward curl after slotting as the large tooth particularly shows. The material was Baldwin's No. 7 0·007in thick.

The rotor material was a 1½ per cent nickel-chromium steel, substantially to B.S. S95 with a maximum μ of 740 and a reasonable working max B of about 16 kgauss. Thus only materials of quite normal properties were used in manufacture.

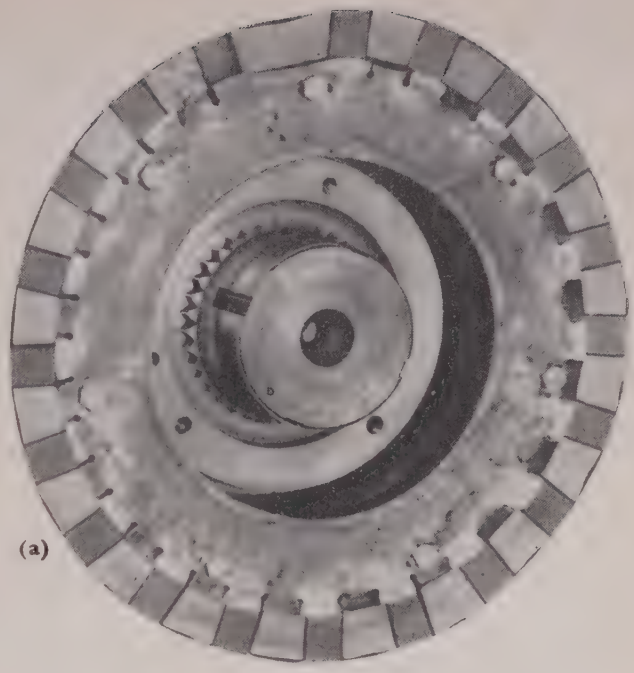
The stationary assembly was carried by means of attachments to the armature core. It is easy to provide a liberal cross-section of the circumferentially continuous middle portion of the core which can take drillings for studs, etc., and leads to the field coil without appreciably constricting the flux paths. The brass field coil bobbin was in turn carried by the core.

Normal excitation was 2,500 amp-turns dissipating about 160 W when fully hot and giving estimated flux densities of about 13·75 kgauss in the air gap, 11 in the circumferential part of the core, 16 in the teeth and 13·35 in the hub.

The slots on the two sides of the core were milled in line and the coils were of the ring-wound type for simplicity. It was also necessary to have only one pair of slots per coil, so that a tooth slot occupied a whole pole pitch. This very coarse slotting, coupled with the essentially single-phase action, resulted in considerable losses in the poles themselves as was expected, but although it was no great detriment for the purposes in view, a modification was made to reduce them, as will be seen. The weight of the components of the machine proper was 24 lb, but this did not include shaft and bearings or a casing since it was mounted into an existing apparatus.

Comparative Actions

Principles. Before going on to results of tests, it will be useful to compare the action of this type of machine with that of the standard construction. Consider the old Gramme or Pacinotti (slotted) ring-wound machines, regarded as alternators. A pair of series turns in, say, a bipolar field will develop the same e.m.f. as a single-diametral turn. They will also possess the same combined inductance and if the bore of the ring is equal to the axial width, the total length of coil wire and hence resistance will be the same. Pursuing this line of argument, it will be seen that apart from a possibly higher ohmic resistance the properties and performance of ring windings are the same as those of surface windings. Drum or surface windings excel chiefly for constructional reasons.



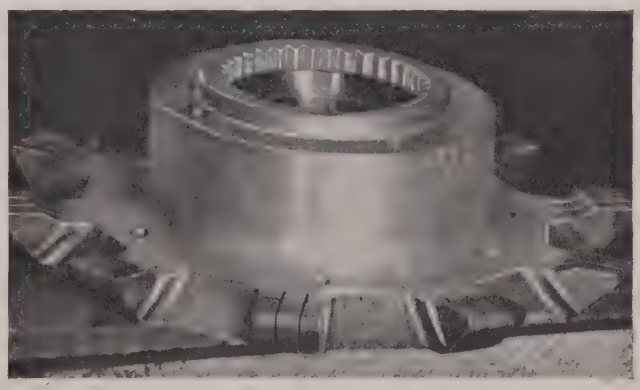


Fig. 2.—Coiled-core alternator as shown in Fig. 1
(a) The armature showing the coiled-core
(b) One half of the solid rotor

Now imagine a ring machine with an armature core of some solid non-conducting magnetic material; laminating does not control the flux paths in electrical apparatus, it only accommodates the paths which would be taken if it were not laminated. Such a machine could have all its north poles gradually moved to one end of the ring while the south poles were moved to the other, during the whole of which time it would continue to perform unchanged. The fact that the flux now enters along one track and leaves by another instead of entering and leaving by the same track in no way affects the linkage or makes the machine less of a heteropolar than it was before. This is exactly what the new arrangement amounts to, with, of course, the necessary laminations re-orientated to suit.

The action of both old and new may be described in the same terms as follows:—

An element of flux enters the core in a plane of the axis, divides circumferentially in opposite directions, each half emerging one pole-pitch away and returning through the magnet yoke by a path which is a symmetrical image of the outgoing one. Every coil is thus interlinked in

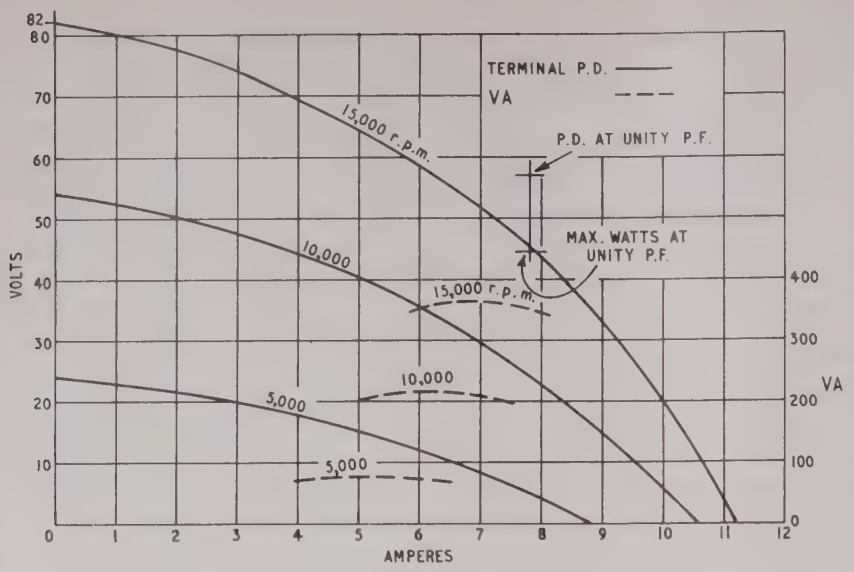


Fig. 3.—Characteristics of one circuit at high lagging power factor

opposite senses by half the effective flux of one pole, each cycle.

The obvious practical consequence of the separate pole tracks is the necessity of providing two sets of teeth. The teeth are actually used in a homopolar manner and this fact probably accounts for the impression of some commentators that the machine is a homopolar. The teeth, however, are mere flux conductors and incidentally have no constricted roots but since they act homopolarly, both hysteresis and eddy losses are approximately a quarter of what they would otherwise be and thus about half for the machine as a whole.

A similar transformation may be imagined applied to a surface-wound machine such as the normal drum type (outside surface) or a.c. tunnel (inside surface). The end loops of the coils are merely bent into the radial slots of the new type core following the poles, and operation goes on as before, each coil being linked in opposite senses by the whole effective pole flux. The coils may have to be longer, other things being the same, and thus of somewhat higher resistance, but this, as will be shown, is a matter of relatively minor importance.

Thus, while ring windings may sometimes be suitable and are not electromagnetically inferior, surface windings are also convenient. The portions not tracked by the poles may be disposed both inside and outside the ring. Designs exist in which such windings are used.

The duty which can be obtained at a given rotational speed with the new machine is limited in a different way from what it is in standard types. Whereas the latter are like a pile of equal transverse plane elements and can be lengthened until whirling is encountered, in the former axial and transverse dimensions are inter-related and a change of axial length involves changes of diametral dimensions also. A strict comparison of the two types has yet to be carried out.

Efficiency as a function of speed. Taking the new machine as equivalent to a standard type speeded up, the effect on efficiency is conveniently considered in terms of inefficiency, $1-\eta$, or losses as a proportion of total energy. The losses affected by speed which produce heating are those of the armature iron and copper. Of these, hysteresis is the same per cycle and hence proportional to speed and thus an unchanged proportion of the total energy. Eddy losses per cycle are inversely proportional to the time and hence, as a whole, proportional to the square of the speed and thus inefficiency is proportional to speed. But eddy losses can be reduced by using thinner laminations where an inverse square law also applies. Winding losses are unchanged by speed and hence their inefficiency is inversely proportional to speed which tends to offset any extra resistance they may have in the new construction and, of course, the h.f. resistance may increase appreciably.

The remaining loss, which in practical effect cools rather than heats, is windage, and as this follows a cubic law its inefficiency is proportional to the square of the speed and may conceivably have to be considered in, for instance, the design of the poles.

Other features. The fact that the excitation is provided by a single coil of circular cross-section makes it the most efficient possible, though this has led to criticism on the ground that the field system has a long time-constant. Whilst literally true this is not a valid objection since it is not because the coil has any higher inductance than the group of individual pole coils (which is a matter of field energy established), but because the resistance is less. If the difference of resistance were added externally, the two systems would be indistinguishable.

Again the excitation of every pair of poles is the full ampere-turns of the coil so that a design employing a large number of poles for high frequency is not handicapped by the limited space available for individual coils. In principle, the armature power developed per pole would be independent of the number; actually, flux leakage would prevent this from being followed very far.

The machine has been described as an inductor type presumably because the field winding does not rotate. But an inductor action suggests an intermediate magnetic member between poles and armature. The machine, however, is as much a rotating pole type as any other.

All the means of manipulating waveform in the standard types of machine can be employed in the new type.

Test Results

All readings were taken on one of the twenty circuits. This comprised 56 turns of 18 s.w.g. copper. The remaining circuits were loaded non-inductively throughout the tests for a slightly higher current than corresponded to their estimated maximum dissipation at top speed. The short-circuit current on a test coil adjoining the wide tooth was not quite as high as on the main test coil, showing that the tooth increases its inductance by a small amount. However, the effect of that on overall performance was probably no greater than other test uncertainties; so the rating of the whole machine is assessed at twenty times the test coil figures.

All loadings on the coil under test were as non-inductive as possible, a variable resistor being picked for this

property. However, it was found to possess an inductance of about 100 μH in the region of three-quarters of full current loading which implies a p.f. of about 0·96 lagging. Potential difference was measured near the coil itself. The fact that this was sensibly zero with the resistor short circuited shows that the impedance of leads and ammeter was negligible.

The instruments were moving-coil d.c. with rectifiers, calibrated to read r.m.s. values with sine-wave quantities over the frequency range of the tests. The actual waveforms of the machine departed somewhat from the sine and the form factor would be higher than the corresponding $\pi/2\sqrt{2}$ and performance better than recorded.

Fig. 3 shows the volt-ampere characteristics for three speeds together with the peak portions of the product curves. The e.m.f. came close to the calculated value, but the reactance proved to have been considerably under-estimated. It is probable that armature flux leakage is greater than in an equivalent standard type of machine. The curves indicate a maximum available output for the twenty circuits of 7·25 kVA. When fully hot, the coil resistance measured by d.c. was 0·192 Ω. There would be some increase on this due to skin effect. If we allow 0·25 Ω for the coil and assume a truly non-inductive load we should have a peak power point of 57 V at 7·8 A or 8·89 kW useful power available.

Fig. 4 shows the open-circuit potential difference and short-circuit current as functions of speed. The early rate of climb of the current curve is as if resistance were about 2 Ω. The explanation appears to lie in the fact that the neighbouring circuits are not fully short circuited and this allows more flux leakage from the test coil and increases its reactance. The part curve shown by broken line was obtained when some much lower resistance loads were connected to the other circuits. A more nearly proportional open-circuit potential difference line was also obtained with the low-resistance general load.

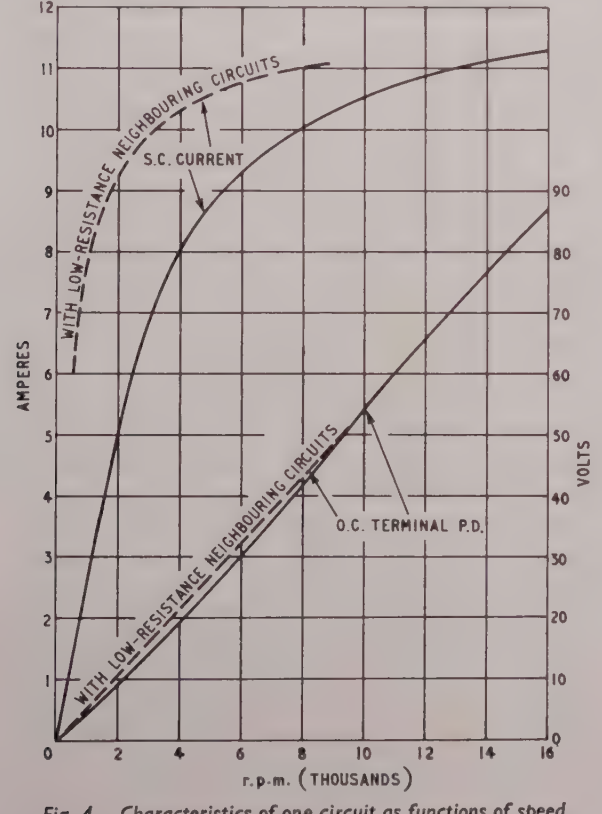


Fig. 4.—Characteristics of one circuit as functions of speed

The maximum current density in the coil amounts to about 6,000 A/sq in which, though high, is not outside present-day practice, and the skin effect would increase this to some extent in actual conductor utilisation. The coil does not reach damaging temperatures; it receives a strong blast of air from the poles. The calculated core losses are about 260 W and the temperature quite moderate. It was found that in running the poles became so hot despite the air flow over them as to form a blue oxide. As a simple way of reducing the pole losses each pole had two slits cut in the plane of the axis which can be seen in Fig. 2 (b). This largely stopped the visible oxidation and reduced the power consumption of the driving motor by over 2 kW.

A few other tests were done, such as varying the excitation, but they do not merit special notice here. A test in which the front and rear air gaps were adjusted to the same total as before but with a difference of 0·040in resulted in virtually no change of performance.

Further Developments and Applications

To obtain the utmost capacity from a given size of machine obviously it would have a solid or nearly solid hub to provide the maximum cross-section for flux. Next it would be made polyphase and thirdly it would take advantage of the speed which its construction permits. These conditions applied to the machine tested would multiply its capacity a few times over. Other things concurring, it is preferable to tend towards using a high rather than a low number of poles.

As the designs come out somewhat short axially it should be practicable to make tandem machines on a single pair of bearings without whirling troubles. Where suitable a permanent magnet hub could easily be embodied. Its surface velocity would be moderate and it would allow extra room for the armature assembly.

In some cases it might even be worth using air gaps of conical instead of disc geometry.

The machine meets the demand of the aircraft industry for a light high-speed generator without brushes which could be built into a gas turbine engine without gearing and contained within the main diameter. It could be direct coupled to turbines for railway or ship propulsion supplying d.c. motors through rectifiers.

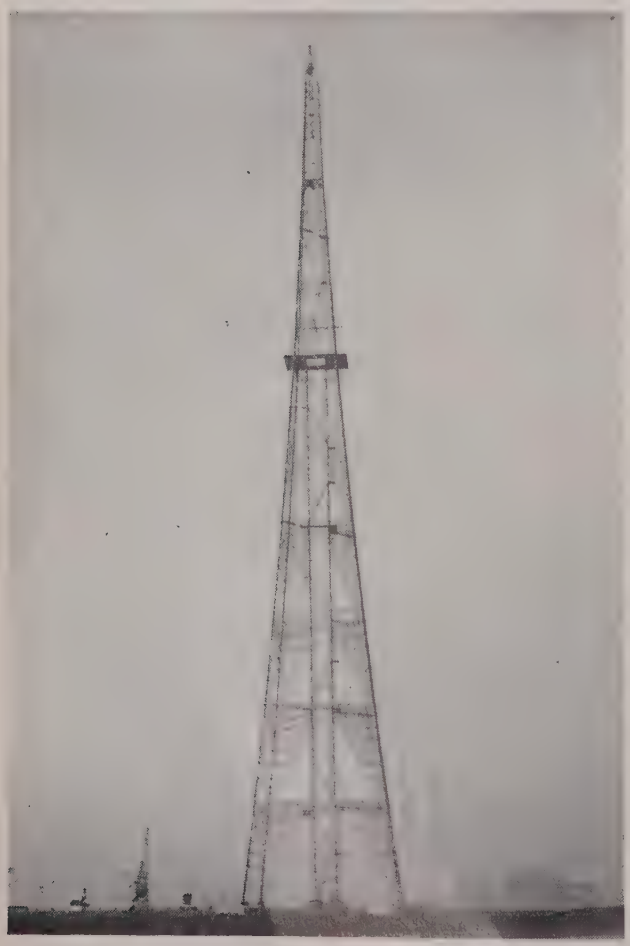
In the industrial field such as electric furnace operation, it is not apparent what advantages other types of h.f. alternator have over the proposed machine where a high frequency is desired for its own sake, even if the rotational speed is limited by other things to much less than an unfettered design would favour. Machines for such cases would tend to become (like many existing machines), concentrated in an annulus of narrow radius, but still aim at taking advantage of high peripheral velocities.

Apart from the mechanical refinements necessary for high speeds, the machine does not demand great precision in manufacture. Stray flux may affect bearings though no trouble occurred on the machine tested, but screening coils are provided for in the original specification.

The author thanks Rolls-Royce, Ltd., for facilities to try out the scheme and for permission to publish this article. The strip core was made by Newton Bros. (Derby), Ltd.



Top section of a crossing tower, showing conductor cross-arms and maintenance platform



615ft crossing tower

WEST THURROCK-NORTHFLEET CROSSING

A major step in the closure of the 275 kV ring around London is the River Thames crossing between West Thurrock and Northfleet. This crossing, which will be strung next summer and will be commissioned next winter, employs two 615ft transmission towers. The design will allow for a future uprating to 400 kV

THE 275 kV supergrid lines at present in operation extend from the North of England through the Midlands to London and South Wales. Extensions now under construction include a line from Northfleet to Canterbury and Lydd. This line will be connected into the supergrid system by the Thames crossing between West Thurrock and Northfleet. Eventually the 275 kV ring around London will be closed by a connection between West Weybridge and Northfleet. The first part of this connection is now being constructed between West Weybridge and Chessington, while the route between Chessington and Northfleet via Beddington is still in the preliminary planning stage.

The West Thurrock crossing of the Thames, now under construction, is due for commissioning at the end of this year and it is hoped that it will coincide with the commissioning of the line to Lydd and the cross-Channel cable link with France. The West Thurrock crossing is due to be strung next summer and, in line with a recent C.E.G.B. decision, it will be suitable for uprating to 400 kV (see *Electrical Review*, 9th December, 1960).

Tower Design

Because of the span length of 4,500ft and the minimum 250ft clearance required by the Port of London Authority between the lowest point of the span and a mean high water, special attention was given to the conductor tower design for the Thames crossing. The two crossing towers are square in plan, the height being 615ft and the base being 100ft square. The overall length of the top cross-arm is 74ft. Each tower consists of eleven panels, the lower five panels taking the form of modified K bracings, followed by a series of open diamond and scissor braced panels.

At the top of the third pair of panels (375ft) is situated the main maintenance platform which will carry an overhead track and trolley with winching equipment for lifting spare insulators. Further maintenance lifting gear is situated at the top of the tower. A particular feature of the towers is the 15ft square central column which is carried up as far as the 375ft maintenance platform. This column was designed to assist in the erection of the six lower panels of the tower by providing a base for the derrick and also to give a structure around which a central

stairway could be built of standardised units, with radiating catwalks out to the aircraft lighting panels. They also form central lifting wells for maintenance material and equipment.

The anchor towers are also fabricated from high tensile steel, and each consists of four panels of 30, 41, 41 and 33ft high, each panel forming an open diamond structure. They are, however, provided with three pairs of auxiliary cross-arms which support the " jumpers " or connections between the incoming lines and the crossing conductors. The detail design of the towers was carried out by Blaw Knox, Ltd.

Insulators

Mounted at the end of the suspension tower cross-arms are universal bearings from which the insulator assemblies are hung. These insulator assemblies, manufactured by Bullers, Ltd., will have jacking equipment to allow the insulator strings to be removed for servicing, and inspection of the universal bearings will also be possible without disturbing the insulators. The suspension assemblies on the crossing towers consist of six insulator strings in parallel, and the tension sets have eight parallel strings; all the insulator assemblies incorporate lever balancing between strings and are designed for equal load sharing in the event of one string failing. Each string consists of 20 porcelain units in both the suspension and tension sets, two extra units being fitted to each tension set to improve the wet flashover values due to the bunching of eight strings in one assembly. The diameters and centres of the units are 14in by $6\frac{3}{4}$in in the suspension sets and $12\frac{3}{4}$in by $7\frac{1}{2}$in for the tension sets, the overall length being $275\frac{1}{2}$ and $294\frac{3}{4}$in respectively. Ball-and-socket insulator couplings are used throughout. The ultimate load figure for the suspension sets is 180,000 lb, whilst that for the tension sets is 240,000 lb.

Conductors

The standard conductors which the C.E.G.B. employs for the 275 kV supergrid are twin 0·4 sq in steel-cored aluminium conductors per phase. Whilst these would not have sufficient strength for the 4,500ft span of the crossing, the experience gained by the Board with this type of conductor led to the development of a 199-stranded, steel-cored conductor, using 91-120 tons/sq in grade steel wires as a core with 108 strands of aluminium arranged in three layers over the core. This conductor matches in capacity the twin conductors of the incoming lines and has sufficient diameter (2·262in) to accommodate the maximum operating voltage of 400 kV without corona losses arising. Its high mechanical strength, necessary to obtain an economic sag, is shown by the calculated ultimate strength of 290,000 lb, and the modulus of elasticity at $14{\cdot}25 \times 10^6$ p.s.i. Its maximum working tension is 97,200 lb. In working out the design, account was taken of the aerodynamic effects which might be expected with long spans of this nature, in addition to the routine meteorological aspects. The design radial thickness for ice loading is 0·5in and the wind loading figure is 15 lb/sq ft.

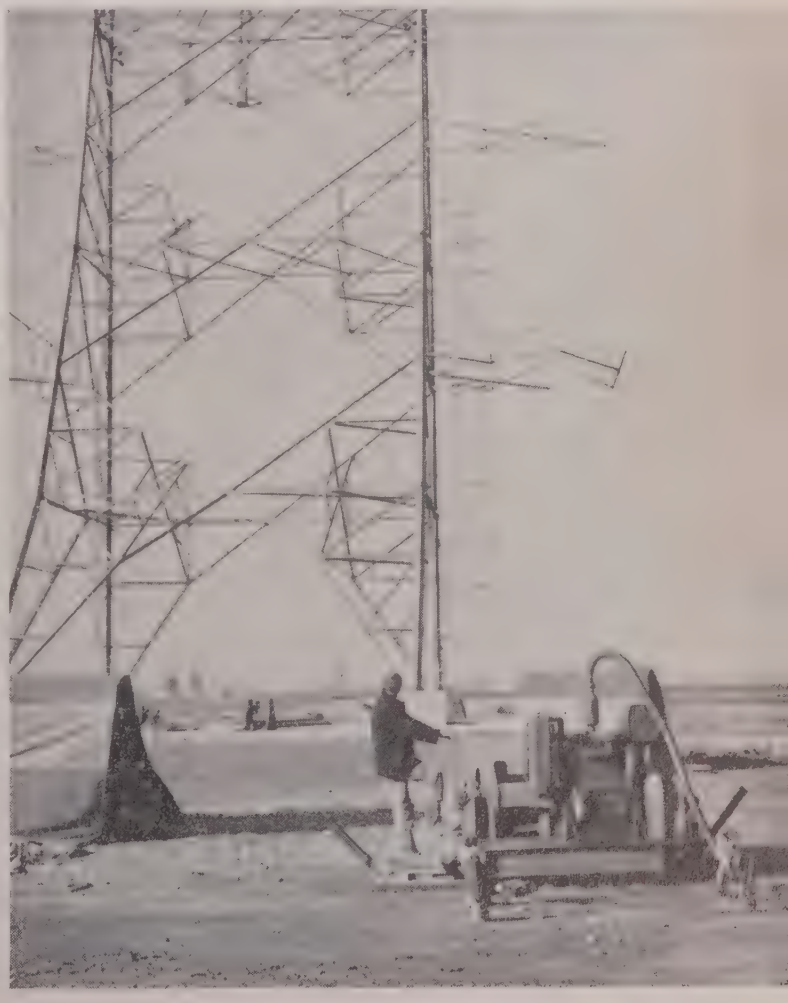
A central over-running earth wire of the same construction as the conductors will be employed on the crossing. This wire will give a shielding angle of 45° and by using a conductor for this duty, uniform mechanical characteristics and economic life are obtained together with a measure of convenient interchangeability. The conductor has been manufactured by British Insulated Callender's Cables, Ltd.

Construction

The foundation work for the towers was started on both sides of the river early in 1959, tower construction commencing in August, 1959. The foundations for the crossing towers consisted of 30 reinforced concrete piles, each 17in square, at each of the four legs of the tower, and at the anchor towers 100 piles are provided at the rear to resist overturning forces. The piles were taken 40ft deep on the north side and 45ft deep on the south bank. The survey work in setting out the towers was particularly intricate; all four towers are aligned to within $\frac{1}{4}$in over a total length of 7,700ft. The crossing span is 4,500ft and each anchor span is 1,600ft. The spans were checked with a geodetic theodolite, a telurometer being finally used to check span distance over the 4,500ft to within 3in. The exceptional accuracy of alignment was obtained by mounting neon tubes vertically on masts at each site and aligning them by night-time theodolite observation under v.h.f. radio control.

The building of each crossing tower by British Insulated Callender's Construction Co., Ltd., began with the erection of the first 125ft of the central column and upon this

Anchor tower steelwork being raised with a Sykes winch



an 80ft derrick was mounted in a lifting rig for the erection of the first 60ft panel of the tower. When this panel was complete the central column was erected another 60ft, the luffing derrick was also lifted up 60ft, and erection was continued on the second panel of the main structure. Above 350ft, this derrick was later used as a floating rig for the main construction.

The winching duties for raising all men and components at the crossing towers were carried out by a modified Sykes No. 8 winch driven by a Lister engine. A further Sykes No. 7 winch, with a Ruston engine, was used as an auxiliary on each tower. At the anchor towers the main winch employed was a No. 7, the auxiliary being a No. 6 size.

The most intricate section of the construction of the crossing towers was the erection of the top maintenance cross-arm, which required an additional derrick at the 600ft level. The cross-arm was erected, section by section, 615ft above the ground, early sections being stayed. When this unit was completed, the six lower insulator cross-arms were raised into position. These units each weighed 2½ tons and were pre-assembled on the ground.

The running of the conductors presents certain facets of interest. The procedure to be adopted will consist of laying a track and haulage rope in the river, each end being passed over the tops of the crossing towers on wheeled paddles. At times agreed with the P.L.A., the river will be closed and these ropes will be hoisted out of the water and tensioned by winches and tackle at the rear of the anchor towers. The haulage rope and track rope will then be " stitched " together by means of a set of trolleys running on the fixed track rope and pulled by the moving haulage rope. When the system is completely stitched and ready, it will carry the conductors by means of a further set of suspension trolleys which will be hauled over the crossing, the suspension trolleys being fed on at one end and the stitching trolleys being removed at the other end. The conductor drum will be mounted on the north bank and the haulage winch on the south bank. (All operations will be directed by v.h.f. radio control.) One of the conditions of the contract is that no conductor shall touch water or land at any stage, this being necessary due to the need to prevent any possibility of damage to the cables and thus giving rise, amongst other things, to corona losses. As each conductor is received across at the far anchor tower, it will be tensioned at both ends and released from the suspension trolleys; this is possible as the sag of the track rope system will be greater than the sag of the conductor in its service position. Tension and suspension insulators will then be inserted at the anchor and crossing towers and the track rope and trolley prepared for the next conductor by reversing the haulage rope, re-attaching the stitching trolleys and recovering the suspension trolleys at the north bank anchor tower.

The main contractors for the C.E.G.B. are the British Insulated Callender's Construction Co., Ltd., the detail tower design being by Blaw Knox, Ltd. Steelwork for the suspension towers was fabricated by Horseley Bridge & Thomas Piggott, Ltd., whilst that for the anchor towers was fabricated by Painter Bros., Ltd. The foundation design consultants were Sir Alexander Gibb & Partners, the foundations being emplaced by Holloway Bros., Ltd., and Mears Bros., Ltd. The conductors are being supplied by British Insulated Callender's Cables, Ltd., and the conductor erection equipment by John Barnsley & Co., Ltd. The anchor clamps, armour rods and vibration dampers are supplied by Alcan Industries, Ltd., the insulator assemblies being manufactured by Bullers, Ltd.

EUROPEAN NUCLEAR RESEARCH

THE 1961 budget of CERN (Counseil Européen pour la Recherche Nucléaire) will amount to 67·7 million Swiss francs. This was decided at the 18th session of the Council held recently. The budget will cover capital expenditure on new experimental apparatus to be used in connection with the two new particle accelerators at Geneva, particularly that associated with the 25 GeV proton synchrotron. Other items are the very large amounts of electric power consumed by the accelerators; the maintenance of the apparatus and buildings on CERN's 100 acres of experimental facilities; and the salaries for the staff of over a thousand.

The representatives of the 13 member States also elected the officers for 1961. Mr. Jan Willems (Belgium), Professor Edoardo Amaldi (Italy) and Mr. Jan Hendrik Bannier (Netherlands) were appointed vice-presidents of the Council. The chairman of the Scientific Policy Committee will be Professor Cecil Powell (United Kingdom) and Dr. W. H. Alexander Hocker (Federal Republic of Germany) will be chairman of the Finance Committee.

At the same meeting of the Council, Spain was accepted as the 14th member State of CERN. As from 1st January, the Director-General of CERN will be assisted by a Directorate consisting of five members. The Director-General will head the organisation and there will be two members for research, one for administration and a member for applied physics. The present Director-General is Dr. J. B. Adams, who is returning to the United Kingdom next August. He will be succeeded by Professor V. F. Weisskopf. The two members for research will be Professor G. Bernardini (Italy) and Professor Weisskopf. The member of the Directorate for administration will be Mr. S. A. Dakin (United Kingdom) and the member for applied research will be Dr. M. G. N. Hine (United Kingdom).

Electricity in Russia

IN 1961 electrical power generation in Russia will exceed 327,000 million kWh. This was stated by Vladimir Novikov, chairman of the State Planning Committee, on 20th December. It was planned to bring about a further increase in the capacity of the supply industry mainly by building thermal power stations. New stations with a total capacity of 7,800 MW will be put into operation in 1961. The construction of a number of large new power stations, with a total capacity of about 15,500 MW, will be commenced during the year.

VIEWS on the NEWS

By "REFLECTOR"

MINERS have again raised objections to the use of electricity for heating. This time it is at Royston, a mining town near Barnsley where it has been decided to install underfloor heating and only two fireplaces in a new working men's club. One miner is said by the *Yorkshire Evening Post* to have described this as "sacrilege" when the members of the club depend on coal for their livelihood. The secretary of the club pointed out that electricity is replacing coal in every present-day working man's home, which is perhaps a little exaggerated. But there was force in his argument (one that I have often used myself) that electricity in the area is generated from coal —not oil.

* * *

Commenting on the possibility of power cuts in this country during the present winter, the *Irish Times* makes reference to the slowing down of the nuclear power programme. It opines that the Calder Hall type of nuclear power station is likely to be "old-fashioned and uneconomic" by the time the present stations are finished, and then falls into error by saying that "no foreign orders for a Calder Hall type reactor, except for a few test reactors, have come as yet." This overlooks the contracts placed with two of the nuclear power consortia for stations in Italy and Japan. The report finishes in Hibernian style with the remark:—

> "So new long-term efforts will have to be made to ward off a power crisis if the winter is a hard one."

* * *

Evidence given at a recent inquest at Abercynin, Glamorgan, showed that the dead woman had been found in her kitchen lying in a pool of water by an overturned washing machine. She had received a fatal shock because, after five or six years' operation, the rough edge of a screw had cut through the insulation of a connecting wire which rendered the frame of the machine "live." As originally installed the machine had a perfectly good earth connection, but the earth wire had been broken and roughly repaired. At the time of the accident, it was found, there was a break in the wire. A witness from the South Wales Electricity Board said that it was important that periodical checks should be made of such installations, advice with which I heartily agree. Washing machines, particularly, are generally installed in conditions which can become very dangerous if anything goes wrong.

* * *

Much interest has been displayed lately in the possible uses of the Peltier effect and thermo-electric couples on a larger scale than has been attempted in the past. Nevertheless I think that a writer in the *Western Daily Press and Bristol Mirror* is going a little too fast when he predicts that in the *near future* heat will be applied to a thermo-electric ring at the generating station to "send current speeding along the cables to your home to connect with other loops built into your walls, floors and kitchen." He visualises the following method of operation:—

> "Flip a switch one way and the current will flow around the loop in one direction to warm the house. Flip the switch again, and the current will circle the loop in the opposite direction to keep it cool on the hottest day."

* * *

For some years past New Zealand regulations governing the carrying out of electrical installation work have been so strict that it has been an offence for a householder to do his own electrical repairs, unless he is a registered electrician. The enforcement of the regulations to such an extent must have been very difficult and I do not know how such "illegal" work was detected in the ordinary way. I now learn from *Live Lines*, the journal of the Electrical Supply Authorities' Association of New Zealand, that under the Electricians' Amendment Act, 1960, legislative approval has been given to limited repairs—the extent is not specified. The journal rightly says:—

> "The legislature has recognised that it must move with the times; if a law is a bad law, or if it is incapable of being policed, then the law should be altered to meet the wishes and desires of the people to whom the legislature is ultimately responsible."

But it also stresses the need for educating the public in the correct methods of carrying out repairs.

* * *

There is a "period" atmosphere about this note from the *Electrical Review* of half a century ago (6th January, 1911):—

> "A Brixton resident was summoned on Monday by the L.C.C. under its Tramways Act of 1900, for wilfully doing an act to certain apparatus used in connection with the working of an electric tramcar, calculated to obstruct or interfere with the working of such carriage. The grievance of the defendant was that the driver of the car on which he was travelling failed to pull up at the next stopping place after he had rung the bell. He, therefore, knocked the 'breaker' out, with the result that, current being cut off, the car came to a standstill. Defendant said that drivers constantly refused to stop at the stopping places, and his action was really taken as a protest in the public interest. He said that the driver and conductor had been heard to say that, as they were late, they would have to rush the stopping places. The magistrate—who, under the Act, might have imposed a penalty up to £20—ordered defendant to pay one of £2 and the costs of the summons."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Railway Modernisation

READING Mr. J. H. Brebner's letter (your issue of 16th December) one may be excused for feeling that there is nothing wrong with British Railways; yet there is an annual loss of £100 million and another inquiry on the future of modernisation is now taking place.

At the recent British Railways Electrification Conference it was stated that the Manchester-Euston scheme would result in an improvement of 9 per cent in performance over the best which could be expected from present steam power. This is not a very impressive return on an expenditure of £160 million.

Railways in India, South Africa, Spain, Portugal, etc., are extending or initiating systems at 1,500 or 3,000 V d.c. and the world's railway speed record is held by locomotives operating at 1,500 V d.c. Adoption of a third-rail system in urban areas and overhead elsewhere at 1,500 V d.c. would have rendered unnecessary the alteration of 119 bridges and tunnels on the Glasgow lines and 82 on the Crewe-Manchester line. At both Manchester and Liverpool Street there were d.c. systems operating most successfully. It just is not reasonable to introduce the 50 c/s system with its dual-voltage complications and initial running troubles (witness the present fiascos in Scotland and Eastern England).

On the Glasgow lines there are 91 train sets, each of which constitutes a travelling a.c./d.c. substation. There are also eight track feeder stations, a number which would have been adequate if a d.c. system had been employed. The installed capacity of the 91 "mobile substations" is much in excess of that which would be required in fixed substations, due to diversity. Consideration of these facts leads to my criticism, not false premises and the brushing aside of the opinions of other engineers, as suggested by Mr. Brebner.

The maximum loads for "XL" trains on the ex-Midland Division are 140 tons for type 2 diesel-electrics, 275 tons for class 6 steam and 300 tons for class 7 steam. The reasons for double heading are self-explanatory from these figures. The diesel locomotives are under-powered and the expensive expedient of employing two units, each costing £60,000/£70,000, has to be undertaken.

Sheffield, 11. M. W. BURNBY.

Status of Engineers

IT is most pleasing to read that the major engineering institutions are contemplating measures to enhance the professional status of their members. For too long has it been permitted for any handyman to set himself up as a mechanical and electrical engineer and the public at large do not apparently see any difference, as yet, between this title and one with the prefix "chartered" added.

This has the effect of generally lowering the status throughout industry. The answer is "some form of registration of engineers, as in the case of architects, etc.," as your leading article suggests. I should like to see some type of organisation similar to the Association of Professional Engineers of Ontario set up.

The recent Court of Appeal decision to make the Institution of Mechanical Engineers liable for local rates, not to accept it as a cultural society only, should accelerate action. Large and public organisations would be encouraged to qualify their advertisements for technical staff and salaries accordingly.

Neasden, N.W.2. E. SIMONS.

An All-Electric Universe

SINCE I sent you the article with the above title, which appeared in your issue dated 23rd December, I have seen the new Pelican book on "Radio Astronomy" by F. G. Smith. If anyone should have thought that I had not been fair to radio astronomers, I recommend them to study that book. It has a chapter entitled "What are radio stars?" and that chapter has a section entitled "What are radio stars?", so there is no doubt that Dr. Smith poses the question. However, two questions do not make an answer, and the chapter and book afford no clue as to the real nature of radio stars, apart from the suggestion that Cygnus A (my Fig. 6) is a collision between two galaxies, which I begged, and still beg, leave to doubt.

May I correct a silly mistake in my article? NGC 4486 (Fig. 4a) is the radio source Virgo A, not Cygnus A as it is described on p. 1073. On the same page "discharges," column 1, line 25, should be "nebulæ."

Croxley Green, Herts. C. E. R. BRUCE, M.A., D.SC., F.INST.P., M.I.E.E.

Engineers' Guild Conference

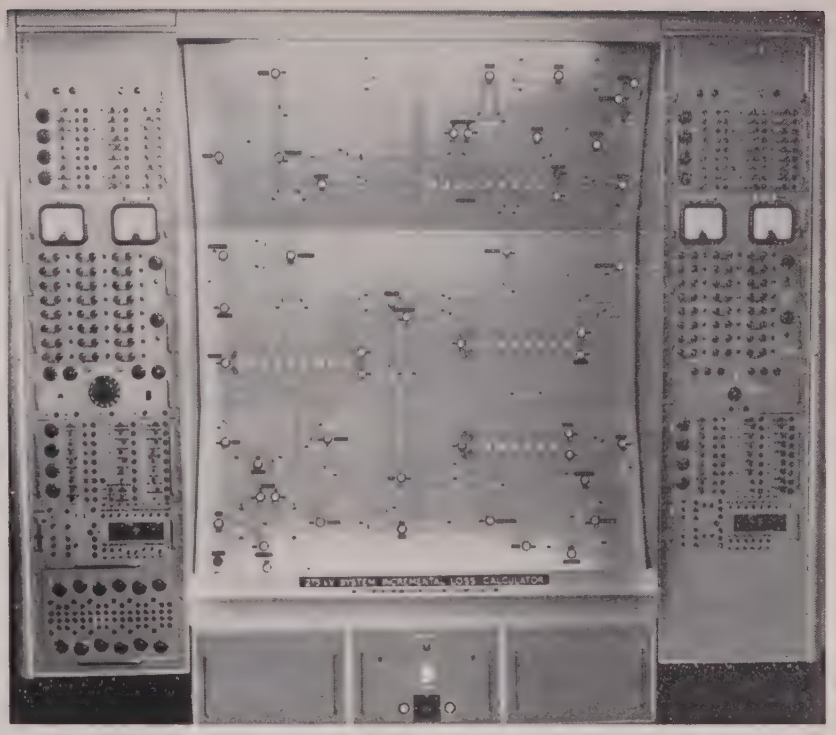
THE theme of a one-day conference to be held by the Engineers' Guild on Wednesday, 22nd March, will be "The Professional Engineer—His Employment and Development" and the chairman will be Sir Hugh Beaver, M.I.C.E., M.I.Chem.E., president of the Guild. The speakers will be Mr. D. J. Mann, a director and head of the Personnel Division of Unilever, Ltd., on "The Engineer and the Technician"; Mr. A. R. Cooper, M.I.E.E., member for operations and personnel, Central Electricity Generating Board, on "The Engineer in Management"; and Viscount Chandos on "The Engineer in Society." The conference is intended for managers, personnel officers and professional engineers. Copies of the programme can be obtained from the Secretary, Engineers' Guild, 201, High Holborn, London, W.C.1.

Domestic Supplement — Spin and Tumbler Dryers — at the end of this issue

THE THIRD HUNTER MEMORIAL LECTURE

By J. S. FORREST, M.A., D.Sc.*

The Hunter Lectures were inaugurated (as a memorial to the late P. V. Hunter) to present a broad survey of some specialist field of electrical engineering to the ordinary engineer with particular reference to the present state of the art and probable developments. In this article, the author summarises his lecture which was given at the Institution of Electrical Engineers yesterday



Incremental loss calculator of 275 kV system

Electronics in the Supply Industry

A MODERN interconnected electricity supply network requires an equally extensive communication network for its efficient operation and control. In addition, apparatus is required for metering, protection, maintenance and testing. Electronic devices and techniques can be utilised for many of these functions with advantages from the points of view of compactness, speed of operation, reliability and economy in communication channels.

Electronic valves were first introduced into certain protective systems in the electricity supply industry some 30 years ago. Many supply engineers opposed the introduction of valves on the grounds of their fragility and unreliability, and it must be admitted that for a long time the circuit designs, components and the constructional methods adopted were poor. Reliability was correspondingly poor, and promising developments were often discredited. In recent years, the position has been much better following the introduction of stringent specifications, and the realisation that electronic equipment can be engineered to give a high degree of reliability. Today, electronic equipment has been introduced in most parts of the supply system.

For example, closed circuit television is finding increasing application. In the boiler house, the burners and the furnace flames can be viewed by a water-cooled periscope and television camera, and the picture displayed on the control panels. Television is also used to provide a remote indication of boiler drum water level. Other applications include the viewing of the slag tap-hole in a cyclone boiler and, in nuclear reactors, the examination of areas where the intensity of radiation is high.

There is considerable interest in automatic methods of starting-up plant which will give the maximum speed compatible with safety. These methods consist essentially of a master controller, or computer, which receives information from all parts of the plant and initiates operations at the right time in a sequence determined by the computer programme.

Computers are also being used for logging operational data in power stations. The normal log of readings, which was once laboriously and slowly taken by an operator, can now be printed automatically in a few minutes, and any deviations from preselected values printed in red or made to sound an alarm. Averages or standard deviations can be computed, and a continuous record of station performance provided. In nuclear reactors some 2,000 temperatures can be supervised continuously. Automatic control of the power station is now feasible.

Various forms of analogue computer, from simple resistance networks to more refined electronic devices which simulate the system more accurately, have been used to determine short-circuit currents, load flow and stability under different operating conditions. A recent development is the incremental loss calculator, which gives the control engineer information on the cost of supplying an increase in load, taking into account the cost of line losses. This enables the control engineer to determine the most economic way of loading the system. The illustration shows the incremental loss calculator which is used for the 275 kV system loading.

With the increasing size and complexity of transmission systems, there is an increasing need for more communica-

* Director, Central Electricity Research Laboratories, Leatherhead.

tion channels and more rapid signalling. Communication circuits may take the form of land lines, aerial cable suspended from the transmission towers, pilot cores in earth wires or in h.v. cables, carrier circuits on the power lines, or radio links. V.h.f. radio is now widely employed on transmission and distribution systems for emergency operation, maintenance and consumer service. Some years ago, a major power station isolated by floods was kept in communication with control only with the help of v.h.f. radio. At present, the supply industry operates some 200 fixed stations and over 3,000 mobile stations. Other possibilities have been suggested such as the use of hollow high-voltage conductors as waveguides, or the launching of surface waves along the line conductors. Very difficult practical problems would have to be solved before either of these schemes became attractive, and at present the increased use of power-line carrier, u.h.f. and microwave links seem to offer the best way of improving communication facilities.

A recent protective system for use on one of the Generating Board's circuits makes use of a microwave link between the line terminals. It is a phase-comparison transistor system using a transmission frequency of 7,300 Mc/s over a distance of 13 miles. Some 20 communication channels are available and this number could easily be increased tenfold if required. The equipment is duplicated with automatic change-over in the event of failure.

With improved instruments for the measurement of conditions throughout the system and an adequate data transmission network, and data handling equipment at the control centres, it is feasible to control the system automatically. In addition, as has been mentioned, the generating station operation can be controlled automatically, and so the realisation of a completely automatic power system becomes possible.

Coal Production and Consumption

THE pattern of primary energy consumption in the United Kingdom was reviewed by Mr. H. E. Collins, member for production and reconstruction, National Coal Board, in a speech to the Fuel Luncheon Club in London on 20th December. In 1946, coal had supplied 92 per cent of all primary energy consumption and oil 7 per cent. The change in the pattern had been gradual up to 1956, when the proportions were 82 per cent (coal) and 15 per cent (oil). In the succeeding years, up to 1959, the change had been much more adverse to coal. Total energy consumption had fallen to 246 million tons of coal-equivalent and the proportions of coal and oil had become 76 per cent and 23 per cent respectively.

Coal output had now been brought generally in line with demand and there had been revolutionary changes in the techniques of mining. Already 40 per cent of the total output was produced by machines. Efficiency, measured in output per man-shift, worked in 1947, had been little over 21 cwt, whereas today it was almost 29 cwt, an improvement of 33 per cent. This increase in efficiency had been achieved with considerable improvement in the safety of mines. Fatal accidents had been reduced by 43 per cent and serious accidents by 31 per cent.

In the Government's view, formulated in 1957, the upward trend in primary energy consumption was estimated to reach 300 million tons of coal-equivalent in 1965. This view had not been changed, but had been extended in one field to 1975, when power stations were expected to consume some 125 million tons of coal-equivalent and, by the 1980's, their annual requirements would reach 200 million tons.

NEW BOOKS

Silicones. By S. Fordham. Pp. 252; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Price 36s.

Although this book is intended primarily for chemists, since it gives a comprehensive account of organosilicon chemistry and a systematic treatment of the manufacturing processes for silicones, one of the sections deals with their electrical properties and applications. This section, prepared by Dr. J. C. Somerville, occupies some 15 pages and deals with the electrical insulating properties and the application in the electrical industry of silicone fluids, rubbers and resins.—T.R.W.

Alternating Current Machines. 2nd Edition. By H. Cotton. Pp. 328; figs. Published by Cleaver-Hume Press, Ltd., 31, Wrights Lane, London, W.8. Price 21s net.

This new edition contains references to British Standards where they apply, new material on the single-phase series-commutator and universal motors and a chapter on the choice of motors for special purposes.

Fundamentals of Digital Instrumentation. By D. S. Evans, M.I.E.E. Pp. 39; figs. Hilger & Watts, Ltd., 98, St. Pancras Way, London, N.W.1. Price 7s 6d.

This little monograph explains the basic principles of shaft-driven digitisers and an understanding of these principles provides a good foundation for assessing the merits and demerits of most digital systems. Among the subjects covered are coding, decoding, cycling, and sampling and storing.

Principles and Practice of Aircraft Electrical Engineering. By H. Zeffert. Pp. 726; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Price 90s.

Electromagnetic Energy Transmission and Radiation. By R. B. Adler, L. J. Chu and R. M. Fano. Pp. 621; figs. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 116s.

Direct Conversion of Heat to Electricity. Edited by Joseph Kaye and J. A. Welsh. Pp. 356; figs. John Wiley & Sons, Inc., New York. Chapman & Hall. Price 70s.

First Aid in the Factory. By Lord Taylor, W. N. Booth, B. S. Laing and O. Ross. Pp. 140; figs. Longmans, Green & Co., Ltd., 6 and 7, Clifford Street, London, W.1. Price 9s 6d.

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ELECTRICAL MATERIALS IN 1960

Retrospect and Prospect

This annual review of the various factors influencing the production and prices of leading materials used in the electrical manufacturing industry has been specially prepared for this journal by the Metal Information Bureau.

COPPER.—The biggest single factor affecting the world copper market in 1960 was the disappointingly low level of consumption in the United States. At the end of 1959 everything looked "set fair" for consumption generally, with prospects of a high rate of industrial activity in the United States, Europe and elsewhere. The United States itself was emerging from a recession and, after several months of virtual nation-wide stoppage at domestic copper mines and refineries, U.S. consumers had largely run down the metal stocks they had built up in the early part of 1959; they could, therefore, be expected to absorb most, if not all, new output as it became available. In short, it seemed that although a surplus of supplies would again develop sooner or later this might well be delayed until some months had elapsed.

As it happened, although the strikes lasted until the end of January—and some into February—the prospective surplus had begun to show itself as a major factor by about the end of April as American buyers were less active than had been expected. Yet the year was not without its recurring prospects of big output losses and thus the market was to a greater or lesser extent a nervous and unsettled one for almost the entire first six months. Riots in the (then) Belgian Congo in March brought fears for supplies from that source once it achieved independence. Then in April there was nervousness over the threat of major strikes in Chile, and in May the strikes themselves. In May, too, there was the dramatic failure of the "Summit" conference in Paris which renewed fears of a further intensification of the cold war and led to forecasts of increased defence spending and hence a scramble for metal by consumers likely to benefit from new defence contracts. Meanwhile consumption outside the United States (and particularly in Europe and Japan) was booming and spot prices were healthy.

June saw the approach of the date of independence for the Congo and a renewal of the nervousness that had pushed prices up in March. But still, and increasingly, overshadowing the market was the approaching surplus. It was thrown into relief by a statement issued by Mr. H. F. Oppenheimer, chairman of the Anglo American Group, to the effect that not only should producers adjust supplies if output tended to race ahead of consumption but, by implication that they *would* do so. Such action was taken by the Northern Rhodesian and Congo producers in October when output or supplies to the market were reduced by 10 per cent. Later some United States and Canadian producers also trimmed production.

Nevertheless, surplus or no surplus, the rioting and civil chaos that followed the emergence of the Congo Republic as a separate sovereign state on 1st July, and is still very much in the news today, caused prices to stay basically firm throughout July and August despite some slackening in demand. In fact there has been no loss of supplies from the Congo so far.

The economic difficulties experienced in the United Kingdom in the latter part of the year have cast some shadow over the future outlook, but not until the closing weeks of the year was any slackening of demand from fabricators and other new metal users apparent, while Continental demand seemed every bit as good as ever though perhaps no longer inclined to go ahead. The American recession continues.

In September there were rumblings of yet another Chilean strike, this time at the Chuquicamata mine. Considering the urgent need to get the nation's economy back on its feet, after the earthquake devastation earlier in the year, few people were prepared for a long strike and, far from reacting in the usual manner to the threat, prices declined steadily, not only before the strike but throughout October when the mine was completely idle. It was not until November, in fact, that the loss of output (estimated finally at fully 40,000 tons) started to make itself felt on market sentiment and prices began to recover. Following the Chuquicamata settlement in mid-November, sentiment was rather better for a time, partly owing to demand outside America rather exceeding expectations and partly because in November and early December opinion was influenced by the growing possibility of still another major Chilean strike—at the Braden Company's mine—at the beginning of 1961.

The United Kingdom copper wire industry had a better year in 1960 than in 1959. With a diminution of the price war in the cable industry production shot up and in January-October amounted to 224,150 tons compared with only 183,887 tons in the corresponding period of 1959. Besides this, output of most other unalloyed copper products was also up on the previous year and there was a marked improvement in output of semi-finished copper alloy products. Export business in wire has declined owing to absence of Russian orders now that the Soviet Union can freely buy raw copper, but early in the year China took 20,000 tons of wire rods.

At the close of 1960 the copper market had a rather easy tone owing to selling pressure from the U.S.A., but in 1961 it is hoped that the new President will revitalise the American economy to the benefit of the copper market. Barring any really big interruptions in supplies, however, there should be plenty of copper available for foreseeable needs in the coming year.

TIN.—Although tinplate production in the United States in 1960 fell to little more than half capacity, the general statistical position went from strength to strength during the year. Final figures will not be known for some little time yet, but it is thought likely that overall world consumption will have exceeded supplies by rather more than 10,000 tons and perhaps by nearly 15,000 tons, the deficit having been made up by drawing on existing

stocks at consumers' works. Furthermore, some experts have already forecast a further shortfall in 1961—this time amounting to upwards of 7,000 tons.

This growing strength was reflected in successive decisions made at the regular quarterly meetings of the International Tin Council in 1960. With the January-March total export quota for producer countries already fixed at 36,000 tons (some 95 per cent of the pre-curtailment figure), the Council raised the second-quarter limit to 37,500 tons. There was no change for the third quarter, but for the fourth all quota limits were waived and the same conditions apply for the next three months.

The other notable I.T.C. decision in 1960 was that, taken in May, to withdraw the buffer stock manager's authority to buy or sell in the "middle" price range (£780 to £830 per ton). Without this authority he was kept completely out of the market in the second half of the year, but there are some observers who would not be surprised to see him back in operation again helping to prevent a runaway market some time in 1961, should prices move above £830.

Mid-1960 was also notable for the drafting and approval by delegates from the interested countries of a second five-year International Tin Agreement to replace the existing one from 1st July, 1961. It has yet to be ratified by some of the Governments concerned, but such has been the success of the present agreement that it is extremely unlikely that any single Government will withhold its approval. Indeed, most signatories only wish the U.S.A., as the main consumer, and the Sino-Soviet bloc, as a major producing area, would also join the scheme.

LEAD.—In the early half of the year lead made a very satisfactory showing from the producers' point of view. Not only did the effects of the voluntary delivery curtailments initiated by some producers in April, 1959, begin to make themselves felt at last, but there was also a marked pick-up in demand generally (except in the United States) and prices improved steadily.

Despite the more cheerful general tone of the market, however, producers were not without their doubts even at the outset and when the International Lead and Zinc Study Group met in January they voted for continued restrictions on lead, for a time at least, estimating that even with global supplies curtailed until the end of September they would still exceed consumption by something like 50,000 tons. With the removal, at the same meeting, of the restrictions on zinc supplies (also initiated in April, 1959) they feared an accelerated build-up of producers' stocks following the smelting of lead-zinc bearing ores.

How much truth there was in their fears was revealed at the Study Group's meeting in September. Producers' stocks outside the U.S.A., which had risen from 82,000 short tons at the end of 1958 to 127,000 tons at the end of 1959, had increased again to 183,000 tons by the end of July, it was disclosed, and there was—as the latest figures have borne out—every expectation of a further increase in the final quarter of the year despite a temporary improvement in the third quarter. Prices which had already eased somewhat from the levels attained up to and including June, thanks to the quieter trading conditions brought about by holiday considerations, have never really been the same since. Though lead consumption outside the U.S. remained generally good in the last months of 1960, the uncertain economic outlook for the United Kingdom, and to a lesser extent for other areas, adversely affected sentiment. Values drifted fairly constantly downwards, helped by sales of Spanish lead on the terminal market in London. By about the middle of December they had, in fact, reached their lowest levels since 1946 and with more metal readily available than consumers could absorb—despite the continued restrictions—the likelihood is that if there is to be any change in consumption in the early part of 1961, it will probably be an unfavourable one as the battery trade is obviously affected to some extent by the reduced output of motor cars. A very difficult situation awaits the Study Group when it next meets in March. Further reduction in supplies and/or production seems needed, but so far only a few countries have been prepared to participate and three or four leading producers are already carrying unduly large stocks of metal.

ZINC.—The year started off well for zinc with the relaxation in January of the voluntary restrictions on supplies imposed in April, 1959. Except in the U.S.A., a good level of demand at the beginning of the year was progressively improved upon for some time and, with total supplies just about balanced by the level of offtake, prices which began the year in the mid-£90 range were broadly maintained. Since the summer months, when lessened consumer demand (through holidays) made for some shift towards a position of slight over-supply, demand has been, if not noticeably less than in the first half of the year, at least no higher. The economic uncertainties in Europe and especially in this country in the second half of the year have made for a rather subdued market.

Nevertheless, until very recently the supply/demand relationship again tended to even up, thanks to such factors as the major strikes at the Bunker Hill and New Jersey zinc mines in the U.S.A., certain technical troubles at smelters outside the U.S.A., and a marked upsurge in buying by Japan and, to a lesser extent, India.

Now, however, with future consumption prospects—particularly for zinc die castings for motor cars and consumer durable goods such as washing machines and refrigerators—somewhat uncertain, in keeping with the economic outlook, confidence in the market has been shaken recently by heavy offerings of metal from America where there has been a considerable increase in exports of metal smelted in bond from imported ore. If such a tendency continues this year it may well be that there will be some pressure for the re-introduction of controls at the next International Study Group meeting in March.

ALUMINIUM.—The higher price of virgin ingot in mid-December, 1959, contributed to an all-round increase in prices of semi-manufactured products in January. (These were again raised in April, on an engineering wage award.) However, the past year saw no slackening of the boom in the United Kingdom aluminium industry. In fact, if the projections are anything to go by, though final figures will not be available for some little time, 1960 will certainly have proved a new record year as regards both imports of ingot and output of "semis."

Events have underlined the situation and none more so than the continued scramble, begun in earnest in 1959, among the North American giants—Aluminium, Ltd., of

NON-FERROUS METAL PRICE TRENDS

Metal	1959 31st Dec.	1960 31st March	30th June	30th Sept.	30th Dec.
Copper ..	£255 10s	£255	£257	£230 15s	£228 5s
Tin ...	£785 10s	£766	£807	£804	£788
Lead ...	£74	£76 12s 6d	£71 12s 6d	£68 17s 6d	£62 5s
Zinc ...	£94 17s 6d	£93 15s	£90 15s	£87	£78 7s 6d
Aluminium	£186	£186	£186	£186	£186

Canada, and the major United States' producers (Alcoa, Reynolds Metals and Kaiser Aluminum)—for control of more and more of the United Kingdom fabricating industry. And not only fabricators but also secondary aluminium ingot producers. In the past year, the two leaders in this field, International Alloys and the smelter of the Enfield group, have both become linked with North American interests.

But the American concerns have not been content merely to acquire control of (or, at least, a half interest in) various organisations. More often than not their appearance on the scene has been followed by expansion, or plans for expansion, of capacity. For this reason, as much as any other, the British Government's decision in March to sell off the remainder of its stockpile aluminium had little or no effect on the market. The quantity involved was 37,000 tons—little enough in relation to the then projected 1960 consumption of some 280,000 tons. (Later figures suggest a bigger total still.) But, furthermore, the metal was to be released over a four-year period to the firm from which it was originally bought.

While the United Kingdom and Europe have been experiencing a continuing boom—consumption of primary aluminium in the O.E.E.C. countries in the third quarter of 1960 alone has been estimated at 332,000 metric tons and a slight increase is expected for the fourth quarter—the U.S.A. has remained a disappointing market. All the major producers there have had to cut back their output so much in recent months that the present excess capacity has been estimated at about equal to total consumption there in 1950.

It is hardly surprising, therefore, with what is in fact a current overall surplus, that not everyone is happy about plans put forward in 1960 for boosting world output still further in the next few years. That is probably why British Aluminium (owned as to 49 per cent by Reynolds) withdrew from the Comalco venture in Australia in September. Recently, however, Kaiser has stepped into its place as a partner for the U.K.-based Consolidated Zinc group, which has been trying to develop Comalco and associated aluminium projects in Australia and New Zealand for several years. Some people think the two organisations may well find that they are being somewhat hasty with their schemes. Nevertheless, few, if any, doubt that aluminium's long-term future is as bright as ever.

RUBBER.—The market for natural rubber in 1960 was an erratic one, ribbed smoked sheet on the London market moving from about 34d per lb at the beginning of the year to a peak of 42d in May. A protracted decline from June to early December brought prices down to little more than 24d, since when a small recovery has been seen. Even at the current price, efficient estates can mostly operate profitably. World consumption this year is estimated at about 2,070,000 tons of natural rubber and 1,770,000 tons of synthetic, a total of 3,840,000 tons, compared with some 3,550,000 tons in 1959, the increase being mainly in synthetic rubber, prices of which were reduced in the latter part of the year—styrene butadiene (the most commonly used) coming down to 22½d. Production in 1960 is estimated at 2,055,000 tons of natural and 1,940,000 tons of synthetic—a total of 3,995,000 tons in addition to which releases from the U.K., U.S.A. and Russian strategic stockpiles of natural rubber are put at about 160,000 tons.

The sharp rise in prices in the second quarter of the year was mainly occasioned by heavy Russian demand at a time of peak consumption in the Western World. Then, with a slowing down in Soviet demand and a substantial setback in the motor car industry in America, the U.K. and to a lesser extent on the Continent, tyre makers' demand decreased and as prices declined consumers tended to cut down their stocks. Thus, with production and consumption of natural rubber roughly in equilibrium the stockpile released (although limited at the lowest price levels of the year) resulted in an increase in stocks, especially in Malaya where they rose in the later months of the year to record high levels.

Total world stocks, according to the latest available information, are nearly 700,000 tons—a total large enough to have a dampening effect on sentiment. Prospects for 1961 depend largely on whether—and how soon—consumption revives, especially in the United States. Russia was again in the market in the closing weeks of 1960, but only for a normal volume of requirements. However, with most of the Malayan stock well held, this sufficed to bring about a small rise in prices from the bottom.

IRON AND STEEL.—The United Kingdom steel industry ended 1960 in a roar of activity. Until the Christmas holidays interrupted working, the mills were virtually flat out, the weekly average in November being over half-a-million ingot tons.

All in all the year was a good one for the steel industry, although the emphasis of demand changed during its course. At the beginning of 1960, the industry was working at a high level, with a tremendous demand for flat rolled and light products, especially for sheets from the motor car trade and other consumer goods industries, but with slacker interest in heavy steel like plates and sections and in railway material.

Sheets were so tight that very big imports were made during the year, but as the months wore on, car export difficulties and hire-purchase restrictions affecting other sheet using industries brought an easing in the pressure for sheets, while the capital goods industries picked up, and with them the demand for heavy steel. As the year ended it was the lighter products, including sheets, in which interest was relatively weak, and demand for heavy steel the strongest. Railway and colliery material was in poor demand for the whole twelve months.

Steel production in 1960 is expected to have been in the region of 24·6 million tons, a record. This year, output will probably be similar, but at this distance it is difficult to be sure. Most observers feel that the first quarter of 1961 will be quieter than the final quarter of 1960, but hope for more active conditions in the spring. Much depends on how the consuming industries shape. During 1960 British mills made substantial progress in overseas selling, especially in heavy steel.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets finished 1960 on a very quiet but by no means depressed note, and during the closing week or two industrial share prices were firm enough to suggest a readiness to respond well to any encouragement that may come in with the New Year. Few commentators expect to see much life in markets until the time comes for a relaxation of the credit squeeze, and since the prerequisite for this is presumably a better levelling of the overseas trade balance, progress may be uneventful for a time. Soon, however, a substantial part of the £129 million involved in the bid for Ford Motor shares will be looking for alternative investments (assuming the deal goes through) and providing useful support to markets in which good stock is still in far from plentiful supply.

Colvern Issue

Changes marked in the accompanying price lists, which cover on this occasion the period of nearly three weeks up to the last dealing day of the year, show the firmness of the trend in general and some particularly good individual improvements, including those in Decca, Crabtree, Plessey, E.M.I., Elliott-Automation, Ericsson, English Electric and Reyrolle. There was a very substantial gain also, to 56s 3d, in the 5s shares of Colvern: in declaring an unchanged interim dividend of 10 per cent, the directors proposed a one-for-two scrip issue and thought that if the present course of business were maintained it might be possible to pay a final dividend, on the larger capital, at the same level as for last year, when the final payment was 25 per cent.

Kenwood Manufacturing

No dividend is being paid on the 1s shares of Kenwood Manufacturing for the accounting period of 19 months up to last July, but the outlook was said in an accompanying statement to be more encouraging and an interim dividend of 7½ per cent is being paid on account of 1960–61. It had been announced some months previously that results for the last period were bound to fall short of the estimates made at the time of the amalgamation of Peerless & Ericsson and Kenwood: the late delivery of special machinery for the production of the new Kenwood "Chef" was among the unforeseeable factors which upset calculations. The difficulties reflected in the disappointing 1959–60 profits figures are said to have now been largely overcome. Having varied during the year between extremes of 12s and 3s 9d, the 1s shares stand now at about 6s.

British Electric Resistance

On the strength of a 25 per cent improvement in net profits, British Electric Resistance have raised the

Price Changes in

Company or Board	Nom. Value	Middle price 30th Dec.	Rise or Fall Since 12th Dec.	Dividend Previous	Dividend Last	Yield % £ s d	1960 Highest	1960 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	74		3	3	4 1 0	79½	74
Brit. Elec. 1974/77	100	70		3	3	4 5 9	76	69
Brit. Elec. 1976/79	100	72½		3½	3½	4 16 6	79½	72½
Brit. Elec. 1974/79	100	82		4¼	4¼	5 3 9	90½	81
Brit. Elec. 1967/69	100	91		4½	4½	4 19 0	97½	90
Overseas Electric Supply								
Calcutta Elec.	£1	20/-		7†	7½†	12 4 0	21/-	19/3
East African Power	£1	13/-		8	10	15 7 9	20/3	13/-
Nigerian Elec.	£1	16/-		8	10	12 6 3	19/9	15/6
Perak Hydro-Elec.	£1	18/-	+6d	10	10	11 2 0	21/-	15/3
Electrical Shares								
Aberdare Holdings	5/-	14/3	−3d	17½	17½	6 2 9	19/-	14/6
Aerialite	1/-	7/-	+9d	54	54	7 14 0	9/6	6/3
Allen, W. H.	£1	36/6	−1/-	14	10*‡	5 9 6	43/9	34/6
Allied Insulators	5/-	9/-		—	20	5 11 0*	11/6	9/-
Alwyn Holdings	5/-	23/9		—	12½	2 12 9	30/6	17/9
Anglo-Portuguese Tel.	£1	24/6	+1/3	9	9	7 7 0	29/-	22/6
Arcolectric	1/-	3/9		—	15	4 0 0	5/6	3/9
Aron Meters	£1	67/6	−2/6	15	15	4 9 0	90/-	47/-
Assoc. Elec. Ind. Ord.	£1	40/-	+6d	15	15	7 10 0	66/6	39/6
Automatic Tel. & El.	5/-	16/3	+1/9	17	17	5 4 6	21/9	14/6
Babcock & Wilcox	£1	32/6		13	9	5 10 9	48/9	32/6
Bakelite	10/-	43/6	−6d	15	17½	3 7 0*	52/-	33/6
Baldwin, H. J.	2/-	2/-		20	—	—	2/6	1/9
Berry's Electric	5/-	49/-		30	40‡	4 1 9	51/6	29/6
Bowthorpe Holdings	2/-	8/-	+3d	27	18½*	4 12 6	11/6	7/9
Brit. Elec. Resistance	2/-	7/3x.c.		17½	17½*‡	4 16 6	8/3	4/6
Brit. Elec. Traction: Def. Ord. "A"	5/-	42/6	+6d	35	40	4 14 3	49/3	42/-
B.I. Callender's	£1	49/6	+1/-	13½	13½	5 8 9	61/-	47/9
B.I. Callender's 6% Pref.	£1	18/6		6	6	6 9 9	21/-	18/6
British Thermostat	5/-	30/-		35	20*	3 6 9	32/6	21/3
Brook Motors	10/-	46/6x.d.		25	25*	5 7 6	53/6	43/9
Bulgin, A. F.	1/-	8/-	−3d	50	55	4 11 9*	10/3	8/-
Bulpitts	5/-	16/6		15	16½	4 18 6	23/3	16/6
Burco Dean	5/-	8/9		18	15‡	8 11 6	15/9	8/9
Cable & Wireless	5/-	15/9	+6d	10	10*‡	3 3 6	18/3	14/3
Cambridge Instruments	5/-	30/3x.d.		11½†	12½†	3 7 9	33/-	24/9
Chloride El. Storage "A"	£1	74/6		20	17½*	4 14 0	81/-	65/6
Clarke Chapman	£1	45/-		13½	13½	6 2 3	63/9	45/-
Cole, E. K.	5/-	20/-	+1/3	20	22½	5 10 0	31/9	18/6
Combined Elec. Mfrs.	4/-	8/-		—	12½‡	6 5 0	8/6	8/-
Contactor Switchgear	5/-	15/6	−1/3	14	14	4 10 3	17/9	14/6
Cossor, A. C.	5/-	7/3	−3d	5	Nil	—	10/-	5/-
Crabtree	10/-	28/-	+2/-	20	12½*	4 9 3	39/6	24/-
Crompton Parkinson	5/-	11/-		14	12½*	5 13 9	15/-	10/9
Davis & Timmins	5/-	30/6	−6d	20*	30‡	4 18 3	35/-	17/-
De La Rue	10/-	58/9	+3/9	22½	22½*‡	3 16 6	78/6	47/9
Decca "A"	10/-	53/3	+4/6	20	23⅛	4 7 6	51/3	40/9
Desoutter	5/-	50/-		21⅝	30	3 0 0	50/-	37/6
Dewhurst	2/-	7/3		20	20	5 10 3	8/6	7/-
Dictograph Tel.	2/-	9/-	+1/-	20	20*	4 9 0	9/9	7/9
Dimplex	5/-	47/6	+2/6	—	30	2 12 9*	48/-	22/6
Dubilier Condenser	1/-	2/3		25	30	6 13 3*	3/3	2/3
Duport	5/-	12/9x.c.		17½	20	5 4 6*	20/-	12/9
E.M.I.	10/-	43/6	+1/6	20	17½*	4 0 6	58/9	41/9
Electrical Apparatus	5/-	17/-	+1/-	14½	20	5 17 9	18/3	12/9
Electrical Components	5/-	9/6		15	11½*	6 1 0	13/9	9/6
Elec. Construction	£1	31/9		9	9	5 13 3	43/-	31/3
Elliott-Automation	5/-	25/-	+1/9	9·3	12‡	2 8 0	36/-	19/9
Enfield Rolling Mills	£1	46/-	+6d	15	15	6 10 6	56/-	45/6
Engineering & Lighting	2/-	9/6	+1/3	20	20	4 4 3	8/9	5/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

total dividend for the year ended last July from 15 to 17½ per cent, and the directors hope to be able to maintain that rate on capital increased by the one-for-four scrip issue which has now been distributed. According to the report, the successful progress of 1959–60 was achieved with little benefit from the new capital raised in March, and without increasing the selling prices of standard lines: the policy is to work on small profit margins and to rely on expanding turnover to provide higher returns. The current financial period began with a well-filled order book, and turnover in the first four months was above last year's level.

Electrical Investments

Company or Board	Nom. Value	Middle price 30th Dec.	Rise or Fall Since 12th Dec.	Dividend Previous	Dividend Last	Yield %	1960 Highest	1960 Lowest
Electrical Shares—continued						£ s d		
English Electric	£1	35/-	+4/-	14	10*	5 14 3	53/-	29/6
English Electric 3¾% Pref.	£1	11/9		3¾	3¾	6 7 9	13/-	11/-
Ericsson Tel.	5/-	25/6	+4/6	13†	13†	4 3 3	28/6	20/6
Ever Ready	5/-	31/6	+1/3	27½	20*	3 3 6	34/6	23/-
Falk Stadelmann	£1	22/6		10	7½	6 13 3	35/9	22/6
G.E.C.	£1	29/9	−3d	10	10	6 14 6	47/6	29/6
G.E.C. 6½% Pref.	£1	20/-		6½	6½	6 10 0	22/3	19/6
General Cables	5/-	4/3		15	Nil	—	10/-	4/9
Goblin (B.V.C.)	5/-	6/-		7½	12½	10 8 3	13/9	6/-
Hackbridge Holdings	5/-	5/9		20	20	8 14 0*	8/9	5/9
Harland Engineering	5/-	15/3	+3d	14	16*	5 5 0	16/3	13/-
Head Wrightson	5/-	23/-	+2/-	20	14*	3 0 9	31/6	20/6
Heatrae	2/-	13/9	+9d	20	22½	3 5 6	13/-	8/9
Holophane	5/-	17/-		26	30	8 6 9	20/6	16/-
Hoover	5/-	47/6	+9d	60	90	4 14 9*	55/-	39/6
Hunt, A. H.	4/-	17/6	+6d	15	20	4 11 6	24/6	16/9
Intl. Combustion	5/-	24/-	+9d	30	30	6 5 0	46/9	23/3
Intl. Computers & T.	£1	61/3	+2/6	—	10	3 5 3	78/6	58/9
Johnson & Phillips	£1	17/3	+6d	5	Nil	—	24/-	16/9
Kenwood Mfg.	1/-	6/-		—	—	—	12/-	3/9
Laurence Scott	5/-	15/9		15	15*	4 15 3	25/3	15/9
Lister, R. A.	£1	47/6	−4/6	14	14	5 17 9	62/-	52/-
Lucas, J.	£1	62/6	−3/-	12½	13¾	4 8 0	74/6	58/9
Marryat & Scott	2/-	13/6	−1/3	22½	27½	4 1 6	16/9	13/6
Mather & Platt	£1	42/6		10⅝	11	5 3 6	59/-	42/6
Metal Industries	£1	53/3	+9d	14	15	5 12 9	76/3	52/6
Midland Elec. Mfg.	£1	60/-	+2/6	10	12	4 0 0	61/-	53/6
Murex	£1	41/3	+4/9	15	20	5 10 9*	45/-	35/6
Newman Ind.	2/-	5/3		10	12½	4 15 3	5/3	4/-
Oldham & Son	1/-	2/3		17½	17½*‡	7 15 6	3/-	1/9
Parsons, C. A.	£1	46/9	+1/9	8½	9½	4 0 0	59/-	44/-
Philips' Lamps	Fl.10	225/-	+5/-	13·3	17	1 10 0	£12¾	137/-
Plessey	10/-	48/3	+2/-	15½‡	17‡	3 10 6	60/-	43/9
Pullin, R. B.	2/-	13/3	+1/-	25	25	3 15 6	14/3	10/-
Pye	5/-	13/6	+6d	12½	15	5 11 0	19/-	13/-
Pyrotenax	5/-	47/-	+1/6	34	40	4 5 0	56/-	44/3
Radiation	£1	31/9	+3/9	6	12	7 11 0	44/6	28/-
Reliance-Clifton	5/-	22/-		15	15	3 8 3	28/-	22/-
Reyrolle	£1	38/9	+2/9	17½	17½	4 10 3*	52/3	33/9
Richardsons Westgarth	10/-	6/9	+6d	8⅛	8⅛	—	14/9	6/3
Sangamo Weston	10/-	26/3		12½	11*	4 3 9	27/-	19/3
Scott, James	5/-	27/6		24	25*	4 11 0	34/6	27/6
Simon Engineering	5/-	29/9	+9d	—	26·6‡	4 9 3	33/-	28/-
Smith (England), S.	4/-	17/-		17½	20	4 14 3	20/-	15/6
Southern Areas	£1	14/9		Nil	5	6 15 6	16/-	13/-
Strand Elec.	5/-	12/6	+3d	20	14·6*	5 16 9	14/-	10/6
Sturtevant	5/-	14/-	+1/-	15†	15†	8 14 9	24/3	13/-
Sun Elec.	5/-	16/3		15	18½	5 13 9	17/6	15/-
T.C.C.	10/-	42/-		25	35	5 13 6*	48/3	37/3
Telephone Rentals	5/-	22/3	+1/-	12½	15*	3 7 6	24/-	17/-
Thompson (John)	5/-	14/6		25	20	6 18 0	25/9	14/6
Thorn Elec.	5/-	45/-		20	25	2 15 6	55/6	44/3
Thornycroft	£1	24/9	+1/-	6	6	4 17 0	31/-	20/3
Tube Investments	£1	73/9	+2/9	—	14	3 16 0	95/6	65/3
Ultra Electric	5/-	12/6		20	25	10 0 0	29/-	12/-
Walsall Conduits	4/-	11/6	+9d	22½	15*	5 4 3	16/-	10/9
Ward & Goldstone	5/-	27/3	−3d	30	35	3 4 3*	31/3	25/6
Watford	2/-	9/3	−6d	25	25	4 6 6*	14/-	7/6
Westinghouse	£1	40/-	+1/3	10	11	5 10 0	59/9	38/9
West, Allen	5/-	11/6	+6d	12½	12½*	5 8 9	17/-	11/-
Wilkins & Mitchell	5/-	13/3		17	21*	7 18 6	25/9	13/6
Wolf Electric	5/-	13/9		10	12½	4 11 0	14/9	10/9

Bruce Peebles

On the warning to shareholders that no dividend is likely to be paid for 1960, the 10s shares of Bruce Peebles were at first marked down sharply, but picked up later to 13s 9d. They had been quoted up to 36s in the early part of the year. In the company's circular, earnings for the year are said to have been seriously affected by delays in the delivery of important items for the new plant which had originally been expected to be in operation by the middle of the year and to be showing results, in conjunction with extensive reorganisation plans, soon afterwards. Meanwhile, however, the directors describe the rate of incoming orders as encouraging, and a merger with the Belmos company is under consideration. For 1959 there was a dividend of 10 per cent.

Thorn Electrical Loan

Thorn Electrical Industries have issued £3 million 6½ per cent unsecured loan stock 1985–89, which is now in the market at an all-in price of about 98½, to yield £6 12s per cent. It is at present £25 per cent paid-up, with a final instalment of £73 per cent to be paid by 20th January, and will be transferable free of stamp duty until the middle of February. Proceeds of the issue are to be used in the reduction of bank overdrafts, which amounted to just on £3 million at the beginning of December. Security is strong, the principal amount of this and other loan stocks being covered over 2½ times by net assets of the group, and the combined interest requirements nearly four times by average profits of the past five years.

Burco Dean

Profits of £210,000 reported by Burco Dean for the year ended in September were above the figure estimated earlier in connection with an issue of loan stock, but were nevertheless reduced to less than half the level of the previous year by the effects of the credit squeeze on sales of washing machines and other domestic equipment. The dividend is being reduced from 18 to 15 per cent (covered 1½ times by earnings) and the company's preliminary statement on the results indicated that earnings had fallen further in the year now running. A price of 8s 9d for the 5s shares reflects the uncertainties of the early outlook for durable consumer goods, although the company has expressed confidence in the continued expansion of the electrical and other divisions.

REPORTS and DIVIDENDS

Bruce Peebles and Belmos.—Conversations have been taking place between Bruce Peebles & Co., Ltd., and the Belmos Co., Ltd., with a view to a merger of the two companies. In a letter to stockholders, Mr. S. A. Gaskell, chairman of Bruce Peebles, says some time must elapse before details are available, but stockholders will be kept advised of anything affecting their interests. Mr. T. Coughtrie, chairman of Belmos, is a director of Bruce Peebles.

Mr. Gaskell also tells stockholders that delays in the delivery of important items for the new plant which are still not available will seriously affect the current year's results, and it is unlikely that a dividend will be recommended on the ordinary stock. In 1959, 10 per cent was paid.

In his last review Mr. Gaskell forecast that 1960 would be a difficult year. But at that time the management believed that delivery of new plant then on order would be effected in time for beneficial use by the middle of the year and that much of the extensive re-organisation then in progress would be yielding some result shortly afterwards. Some of the benefits of re-organisation are only now evident and others must await the arrival of the new plant. The board, it is added, has confidence in the future of the company. The order book position is satisfactory and the rate of order intake encouraging.

As part of an economy measure Bruce Peebles have given notice to 50 employees.

Camp Bird, Ltd., hopes during the year to complete the programme of concentrating the operating companies into those with stock market quotations so that the parent undertaking may, in future, hold only quoted stocks in its portfolio. At the same time, says Mr. John Dalgleish, chairman, it is proposed to remove the undesirable feature of one quoted company having a controlling interest in other subsidiary quoted companies. In this connection Hartley Baird proposes to make a share exchange offer for the outside holdings in H. J. Baldwin & Co.

No dividend has been recommended for the year ended 30th April, 1960, and Mr. Dalgleish says dividends for the current year must wait on the dividend proposals of the subsidiaries and from other earned income in due course.

In his review Mr. Dalgleish says that it would be prudent to regard the financial year beginning next May as the year in which "all our capital for the first time should be earning; whereas in the past five years the assets actually earning have never exceeded 50 per cent of our capital." Meanwhile, he adds, the company will pursue a course of building up its capital at every available opportunity.

Hartley Baird, Ltd.—In his review, Mr. A. W. M. Hartley (chairman) says that the various subsidiary companies other than Baldwins "on the whole traded satisfactorily despite very intensive competition." In addition to the decision, referred to above, that H. J. Baldwin & Co., Ltd., should become a wholly-owned subsidiary of Hartley Baird, the company is seeking to increase its authorised capital for the purpose of acquiring the Limit Engineering Group, Ltd., a major subsidiary of Camp Bird, Ltd.

H. J. Baldwin & Co., Ltd.—Mr. D. Wright (chairman) refers in his review to the complete reorganisation of the operating and trading methods of the company and its subsidiaries which was initiated a few months ago and says that while the result of these actions will not reflect fully in the current year's trading, a substantial improvement will nevertheless be evident. Mr. Wright said he had no misgivings about the future of the company.

The Appliances Division will in future restrict its future activities to matters in which the company have a special knowledge, such as the manufacture of embedded and other heating elements and electric blankets.

New Companies

A. E. Southey & Co., Ltd.—Registered 21st November. Capital £12,000. Electricians, radio, television and electrical engineers, etc. Directors: A. E. Southey, A. R. Southey, Mrs. Daisy G. Southey and Gertrude B. Southey (secretary). Regd. office: 22, The Broadway, Southgate, N.14.

Elgee (Refrigerators), Ltd.—Registered 12th December. Capital £100. Manufacturers of and dealers in refrigerators, etc. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

Bexelectric, Ltd.—Registered 18th October. Capital £100. Wholesalers, retailers, importers, exporters and manufacturers, servicers and repairers of and dealers in dynamos, motors, armatures, etc. Directors: M. W. Beck, Mrs. Rebecca G. Beck (secretary) and G. N. Henty. Regd. office: 71, High Street, Polegate, Sussex.

Chestercol, Ltd.—Registered 21st November. Capital £1,000. Electricians, etc. Secretary: Shirley Hart. Regd. office: Midland Bank Chambers, High Street, Colchester.

J. & M. Greenwood, Ltd.—Registered 24th November. Capital £2,000. Electrical engineers, etc. Directors: M. A. Greenwood, Joan K. Greenwood (secretary), C. Randle and May G. Randle. Regd. office: 367, Abergele Road, Old Colwyn, Denbighshire.

Liquidations

E.W.D. (Electrics), Ltd.—Winding up voluntarily. Liquidator, Mr. P. Cardwell, 93, Queen Street, Sheffield, appointed 7th December.

Hobson & Hammond (Electrical), Ltd., electrical engineers and contractors, 813-815, Attercliffe Road, Sheffield.—Liquidator, Mr. P. Cardwell, 93, Queen Street, Sheffield, appointed by members and creditors on 15th December.

British Columbia Electric Railway Co., Ltd., 3, Lombard Street, London, E.C.3.—Winding up voluntarily. Liquidators, Mr. L. C. Colton and Mr. W. B. Affleck, of 970, Burrard Street, Vancouver, British Columbia, appointed by the company on 12th December.

New Malden Electrics, Ltd., dealers in gramophones and sound producing machines, 131, Kingston Road, New Malden, Surrey.—Winding up voluntarily. Liquidator, Mr. K. R. Cork, of W. H. Cork, Gully & Co., 19, Eastcheap, London, E.C.3, appointed 13th December. Particulars of claims to the liquidator by 31st January.

Queen Bee Enterprises, Ltd., television, radio and electrical appliance dealers, 38, John Bright Street, Birmingham.—Liquidator, Mr G. D. Hopkinson, Lancaster House, Newhall Street, Birmingham, appointed 5th December with a committee of inspection.

Winding-up Order

Stem (Elec.), Ltd., 72, Boundary Road, Hove, Sussex.—Winding-up order made 12th December.

Bankruptcies

B. G. Slater, lately residing and carrying on business at 12, George Street, Exmouth, Devon, as an electrical engineer.—Order for discharge made 24th November, 1960, suspended for one year and subject to the condition that bankrupt shall pay to the Official Receiver, for distribution among creditors, monthly instalments of £3 starting on 1st December, 1960, for three years from the date of the order.

J. V. Lythgoe and **T. O'Brien,** carrying on business in co-partnership formerly at 385, Halifax Road, Rochdale, Lancs., but lately at 94-96, Cheetham Street, Rochdale, as electrical appliance dealers under the style of "Swift Clean Vac Shop" (joint estate).—Last day for receiving proofs for dividend 12th January. Trustee, Mr. J. A. Freeman, 8, Manchester Road, Bury, Lancs.

C. P. Wheeldon, electrical and general dealer, lately carrying on business at Bryn Awel, Brunswick Road, Buckley, Flint., and 29-39, Mold Road, Buckley.—First and final dividend of 1s 6d in the £ payable at the offices of Parkin S. Booth & Co., 5, Rumford Place, Liverpool, 3.

S. J. Barnes, electrician, residing at 32, Raleigh Road, Coventry, and formerly carrying on business at 3, Pim Street, Antrim Road, Belfast, Northern Ireland, as an electrical contractor.—First and final dividend of 8d in the £ payable at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2.

L. W. Brown, radio, television and electrical engineer, carrying on business at 18, Lower Lux Street, Liskeard, Cornwall.—First and final dividend of 19 5¼d in the £ payable 1st Floor, Royal Building, St. Andrew's Cross, Plymouth.

D. Roberts and **F. J. Webb,** carrying on business together as retailers of domestic electrical appliances under the style of Rowe Electrical Services at 130, Foleshill Road, Coventry, and at Corporation Street, Coventry.—Receiving order made 15th December on debtors' petition. First meeting today (Friday) at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham. Public examination 27th February at the County Hall, Coventry.

H. F. Mouncey, electrical engineer, 4, Cromer Road, Tooting, London, S.W.17.—First and final dividend of 2s 3¾d in the £ payable 13th January at 58-61, York Terrace, Regent's Park, London, N.W.1.

INDUSTRIAL NEWS

Electrical Appliance Approval

PARTICULARS were given in our issue of 21st October last of the constitution and plans of the British Electrical Approvals Board for Domestic Appliances. It was then announced that the Board, as a start, was inviting manufacturers of radiant fires, kettles, blankets and vacuum cleaners to apply for approval of their appliances. Blankets licensed to carry the "Kite Mark" of the British Standards Institution were to be automatically accepted and this applied also to appliances included in the approved list of the British Electrical Development Association. The Board states that the handling of this first group is well under way and successful applicants will be authorised at the end of February to start using the Board's mark. Applications for approval of new models of fires, kettles and vacuum cleaners will now be dealt with as they are submitted.

The Board has now announced the second group—shavers, toasters, coffee percolators and wash-boilers. All known makers of these appliances are being approached and asked to make application for approval before 31st January. Applications received after that date may not be "processed" in time for the simultaneous announcement of approval on 1st May next. Any manufacturers who do not receive information and application forms directly, and agents of overseas manufacturers who market or wish to market appliances in the second group, should write to the Director, B.E.A.B., 27, Cockspur Street, London, S.W.1.

Test and Approval Specification

Approval is based on the relevant British Standards and the British Standards Institution has undertaken to incorporate all approvals requirements in one British Standard—B.S. 3456 "Test and approval specifications for domestic electrical appliances." These specifications will be issued in a number of parts including Part A: Heating and cooking appliances; and Part B: Motor-operated appliances. Each part will be divided into sections: Section 1 will deal with general requirements applicable to all appliances in the group and subsequent sections will cover particular requirements for individual types of appliances.

All these sections will be drafted in a uniform pattern in due course, but for the immediate present some existing British Standards will be re-issued in their present form, but will bear the new number. For example, B.S. 1670 "Electric fires" is being re-issued as B.S. 3456, Part A, Section 2 and B.S. 1645 "Vacuum cleaners" as B.S. 3456, Part B, Section 2.

ELECTRICAL CONTRACTING APPRENTICESHIP

NEGOTIATIONS between the Electrical Trades Union and the National Federated Electrical Association have resulted in a new apprenticeship scheme for the electrical contracting industry, to come into operation on 1st February. In addition to apprenticeship for journeyman electrician the scheme provides for the inclusion of armature winder and telecommunication apprentices.

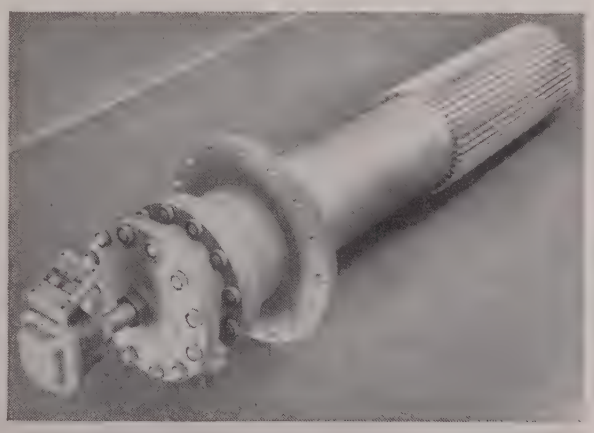
Two categories are established: young persons legally bound by their parents or guardians under a deed of apprenticeship; and others who will enjoy similar conditions but whose engagement can be terminated, after the usual notice, by themselves or their employers. There will be a probationary period for both classes. Normally the apprenticeship will be for five years but the time may be shortened or lengthened if circumstances require it.

Daytime release for attendance at classes is provided for. The wages paid during apprenticeship will range from 20 per cent of the journeyman's rate at age 15 to 72½ per cent at age 20. An extra 2d an hour can be paid to apprentices passing approved examinations. There will be two weeks' holiday with pay. The scheme applies only to England and Wales.

Flameproof Immersion Heater

A FLAMEPROOF type immersion heater recently supplied by the A.E.I. Heating and Welding Department to Connolly's (Blackley), Ltd., of Liverpool, rated at 15 kW, 415 V, three-phase, is designed to meet the requirements of very low heat dissipation. Maximum loading was specified as 4 W/sq in of surface, and this was achieved by using cast-in elements and exterior finning. The nine U-bent mild steel elements are cast in aluminium inside the main tubular body which has 48 external fins.

The surface of the heater is coated by a chrome diffusion process to avoid contamination of the liquid to be heated. The Maclaren thermostat for temperature control over the 200-300°C range is fitted with a Buxton certified flameproof head, and the heater terminal box is designed in line with Flameproof Specification B.S. 229. In use, only the finned portion of the unit is heated, the elements being provided with cold extensions. This ensures that, within prescribed limits, a fall in level inside the kettle does not result in decomposition of the liquid around the exposed portion.



A.E.I. immersion heater for Connolly's (Blackley), Ltd.

Aviation Industry Guide

The 13th edition of "Sell's British Aviation," covering the year 1960, has recently been published by Business Dictionaries, Ltd., St. Dunstan's House, 133-137, Fetter Lane, E.C.4, price 20s. This guide to the British aircraft industry provides details of aircraft constructors and manufacturers of associated equipment. The first section contains the names of all principal firms in British aviation and the second is a classified trade guide to manufacturers, dealers and aircraft operating companies. This is followed by a trade names and trade mark section, details of various aviation associations and brief particulars of civil aircraft currently in various stages of production.

INDUSTRIAL NEWS *[continued*

Power Station Inquiry

BEFORE Parliament adjourned until 24th January, the Conservative M.P. for South Nottingham, Mr. W. Clark, referred to the inquiry into the proposed power station at Holme Pierrepont which, he said, would be the largest in Europe. Since the inquiry was proceeding he could not discuss the merits or demerits of the site, but the public, he said, were rather suspicious of the inquiry itself. Among the circumstances that led to that suspicion was the " secrecy " surrounding the Central Electricity Generating Board's claim that £600,000 a year would be saved if the station were at Holme Pierrepont and not at an alternative site proposed by the County Council.

The Parliamentary Secretary, Ministry of Power (Mr. George), said the Minister did all he could to ensure that openness, fairness and impartiality ruled at any inquiry he authorised and he had no reason to think this one would be different from any other that had been held under the Electricity Acts.

It was said that the Board had not complied with the objectors' demand that details should be produced of how the saving of £600,000 a year was calculated. The Board felt bound to respect the sanctity of private contracts and were not prepared to disclose details of them for public scrutiny. However, they had suggested that the objectors appoint a competent person to check the complex calculations, a suggestion turned down because access to the actual contracts would not be granted.

Mr. George said he was now authorised by the Board to say that if such a person were appointed, as they hoped, he would be given access to the relevant documents including the contracts under a guarantee of secrecy.

He mentioned that 16 joint inquiries had been held under the Electricity Acts. Fifteen had lasted three days or less, including inquiries covering proposed nuclear power stations; and one had extended to four days plus two half-days. The Nottingham inquiry had lasted 10 days plus two days for inspecting sites. It would resume on 23rd January.

NIGERIAN HANDBOOK

The fourth edition of the "Handbook of Commerce and Industry in Nigeria" (price 15s), published by the Federal Ministry of Commerce and Industry on the occasion of the country's independence, is larger and more comprehensive than earlier editions. It is an essential reference book for those doing business with, or considering investment in, Nigeria. The detachable supplement includes plans of seven towns and four maps showing the location of industries and natural resources, communications, regions and provinces and physical features.

SMOKE CONTROL IN GLASGOW

Glasgow's fourth smoke control area, covering 2,794 acres and 9,000 houses in Pollokshaws, came into operation on 15th December.

On the previous day, Glasgow Corporation Health and Welfare Committee recommended that a sixth smoke-control area, covering the western part of Pollokshields and extending to 2,010 acres, should become effective from 1st November, 1961. It was also agreed to recommend that the date for enforcing the smoke control order for the older part of Pollokshields should be postponed to 1st May, 1962.

Nickel and Chromium Recovery in Electroplating

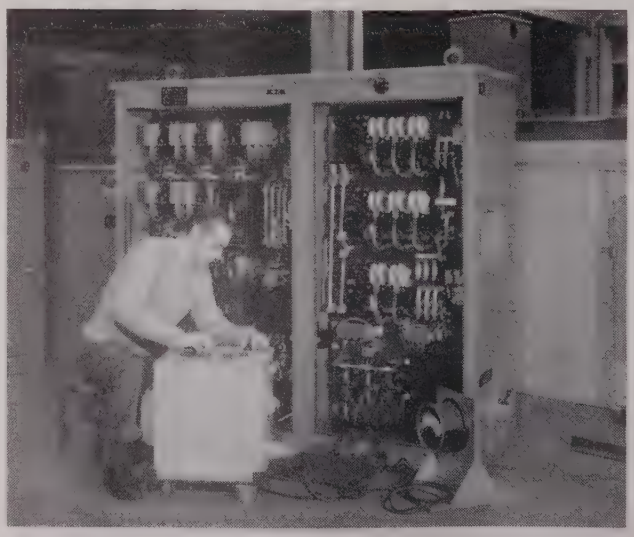
THE results of a survey on wastage of nickel and chromium salts in the electroplating industry by the Department of Scientific and Industrial Research, in co-operation with the British Non-Ferrous Metals Research Association and the electroplating industry, have been published under the title "A Survey of Nickel and Chromium Recovery in the Electroplating Industry."

Out of an estimated total weight of 2,870 tons of nickel used by the plating industry in 1958, about 290 tons represented the metal content of the nickel sulphate and chloride used. These chemicals increase the total material cost by about 13 per cent. The use of a simple static rinse tank has been found to eliminate three-quarters of the cost of these added salts. The installation of such a tank in a manually-operated plant is usually inexpensive, and the outlay may be recovered within one year. It is also considered that there is great potential value in the ion-exchange process for the purification and re-use of effluent solutions, but at present this process is handicapped by the initial cost of equipment and lack of operating experience. Copies of the booklet can be obtained, free of charge, from the Library, Department of Scientific and Industrial Research, 5-11, Regent Street, London, S.W.1.

Short-circuit Ratings for Power Cables

Reference was made, under the above title, in our issue of 23rd December to the contribution to the discussion by Mr. A. G. Thomas on two papers presented to the Institution of Electrical Engineers. Mr. Thomas was reported as saying that a 0·19 sq in cable withstood 46 kA for 0·42 sec; the actual figure was 46 kA for 0·20 sec. This cable had an aluminium conductor and sheath.

Crane Control Gear



Final tests being made to one of the contactor panels to be used for controlling a 32 ton three-motor crane for use in the construction of the new Forth road bridge. This electrical control gear is being supplied by Allen West & Co., Ltd.

Safety Requirements for Hair Dryers

THE latest in the series of British Standards for domestic electrical appliances, B.S. 3296 : 1960, sets out safety requirements for electric hair dryers. It applies to dryers of the portable-motor type for voltages exceeding 30 V a.c. or 50 V d.c. but not exceeding 250 V a.c. or d.c. The dryers are divided into three types—earthed, double-insulated or all-insulated.

The standard calls for hair dryers to be so made that they cannot endanger the user or the surroundings even if defects occur in normal use. Included are requirements for earthing, kink-resistance of the flexible cords, insulation resistance and electric strength, temperature rise and mechanical strength, with suitable tests. Information on the impact apparatus needed to test the mechanical strength of a dryer is included in the appendix.

Copies of the standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 6s.

REPAIRS AT BOLD

Following the turbine explosion at Bold "A" power station (see *Electrical Review*, 11th November), new parts for the damaged No. 2 machine have been ordered by the Central Electricity Generating Board. The explosion also caused severe damage to No. 1 set and No. 3 set was affected. Repairs to these machines have been completed and both sets are now running.

The repairs to Nos. 1 and 3 turbines were carried out by Metalock (Great Britain), Ltd. On No. 1 turbine, the bottom casing and cover of the l.p. cylinder and the condenser door required repairs, while the only damage to No. 3 set was to the turbine cover. This work was completed by Metalock on 6th December and involved 88 man days.

Jackson Cooker Prices

An announcement from the Electrical Division of Radiation, Ltd., states that as from 2nd January adjustments have been made to the prices of the Jackson "Highline" and "Estate" ranges of electric cookers. The new prices are as follows:—"Estate" cookers: model 391P, £30; model 391C, £32; and model 391CT, £37. "Highline" cookers: model 493, £49; model 493T, £54; and model 494T, £59 15s. An untimed version of the "Highline 494" has been introduced this year at £54 15s.



The Christmas window display at Barnsley (Elden Street) Service Centre which was placed first in Class A of the Yorkshire Electricity Board competition

Christmas Window Display Competition

FOR the Yorkshire Electricity Board's annual Christmas window display competition Service Centres were classified as (A) those with a frontage exceeding 20ft and (B) all others. A local judging panel in each of the seven Sub-Areas first selected the best display in each class and the Area judges, Mr. A. Haselhurst (chief commercial officer of the Board) and Mr. S. Agnew Mercer (managing director, Tattersall Advertising, Ltd.) then viewed the 14 Service Centres chosen to make the final awards. The results of the competition were as follows:—Class A: Winner, Barnsley (Elden Street); runner-up, Huddersfield. Grimsby (Victoria Street) Service Centre was specially commended for artistry and originality. Class B: Winner, Leeds (Albion Street); runner-up, Todmorden.

Computers at Perivale

Hoover, Ltd., have recently installed two electronic computers supplied by International Computers & Tabulators, Ltd., for use in their Perivale, Middlesex, office headquarters.

Railway Electrification Programme

THE Minister of Transport (Mr. Marples), speaking in the House of Commons before the adjournment, said that the British Transport Commission planned to complete three electrification schemes in 1961—the London, Tilbury and Southend line, and extensions to schemes already in operation on the Kent coast and to Glasgow suburban lines.

No specific authorisation of capital expenditure for electrification schemes other than those now in hand had been made. He was considering further schemes included in the Commission's 1961 programme and he could not say yet what investment might be authorised. They would have to be considered in the context of the Commission's proposed four-year programme which he had just received.

In a written reply, Mr. Marples said the latest estimated cost of the Victoria line tube was £55 million.

Domestic Supplement—Spin and Tumbler Dryers—at the end of this issue

Projection Equipment for London Lecture Theatre

The projection installation for the Royal Aeronautical Society's new lecture theatre was supplied by A.E.I. Sound Equipment, Ltd. A novel feature of the operating box is a xenon slide projector which has been developed in conjunction with Robert Rigby, Ltd.

Other equipment supplied by the company includes a 16 mm xenon projector, xenon arc rectifiers and a twin electrically-operated motorised roller screen unit.

INDUSTRIAL NEWS *[continued*

TRADE ANNOUNCEMENTS

A NUMBER of new appointments are announced in the Electrical Appliance Division of **Charles Colston, Ltd.** Mr. R. S. Monk has been appointed manager of the southern branch and will be based at 7/11, Lexington Street, London, W.1. Mrs. M. Stevenson becomes a demonstrator for the branch's London district and Mrs. Carole A. Stewart takes up a similar appointment in the south-eastern district. In the northern branch, Mr. N. L. Brooks has been promoted from area manager to Electricity Board liaison manager (Yorkshire and N.E. Boards) and Mr. R. B. Lane becomes area manager in the north-eastern district. In the Scottish branch, which now has new offices at 266, Clyde Street, Glasgow, C.1, Mr. L. G. Dickson has been promoted to Electricity Board liaison manager (South and North of Scotland Boards). Mr. W. Wilson becomes area manager in the South of Scotland district and Mr. W. J. R. Trapp area manager in the North of Scotland.

Mr. B. G. T. Charleston has been appointed sales representative for the **Westrex Co., Ltd.,** covering the South of England and will handle Westrex public address, staff location systems and industrial communications. He will be based at the Cricklewood offices at 152, Coles Green Road, London, N.W.2 (telephone: Gladstone 5401).

J. G. Statter & Co., Ltd., have moved their sales department from London to their works at Amersham Common, Bucks. (telephone: Little Chalfont 2671/5), and all inquiries should be sent to this address. The move has been made to achieve closer co-operation with the Technical and Production Departments.

The district office of **Evershed & Vignoles, Ltd.,** at 14, Yarm Lane, Stockton-on-Tees (telephone: Stockton 64288), is now under the supervision of Mr. D. Watson. The area covered from this office includes Northumberland, Durham, and the Cleveland District of Yorkshire. The northern area office continues operation as a commissioning and servicing centre staffed by Evershed engineers.

M.K. Electric, Ltd., have appointed Mr. G. S. Phillips as area sales representative for Glasgow and the West of Scotland.

Railway Electrification Films

An explanation of the apparatus involved and some of the difficulties to be overcome in transferring power from the national a.c. grid to the new 25 kV locomotives on British Railways is given in the film "Railway Electrification at Industrial Frequency" recently produced by the British Transport Commission Films Service. The film was first shown at the British Railways Electrification Conference held in London in October.

The second of a series of annual films being produced to give an account of the progress of the railway modernisation plan deals with a wide variety of technical achievements with particular emphasis on the freight services. Its title is "Second Report on Modernisation." Both films, which run for 28 and 20 min respectively, are available in both 35 mm and 16 mm sizes.

Calendars and Diaries

The large wall calendar received from Hawker Siddeley Industries, Ltd., has on each sheet a coloured illustration of one of Britain's beauty spots.

A neat desk calendar sent us by Nalder Bros. & Thompson, Ltd., has monthly pages, each of which includes the preceding and following months.

Coloured illustrations of buildings, old and new, are chosen for the 1961 Pyrotenax calendar to represent the wide diversity of applications of the company's m.i. cable installations.

From the Colville Group we have received a wall calendar with three months on each sheet. Two scenic reproductions in brilliant colour alternate with views of the steelmaking process.

A useful desk calendar on stout cardboard has been received from Lec Refrigeration, Ltd.

A street plan of London with one-way streets marked in red is included in the London Electricity Board's 1961 diary which also contains information on the electricity supply organisation in the Area.

The 1961 calendar received from Portaway Earthing Equipment, Ltd., has large monthly sheets with bold figures.

Sound Absorbing Materials

MEASUREMENTS of the sound absorption coefficients of various materials have been carried out for a number of years at the National Physical Laboratory and the results of these investigations are now available in a booklet entitled "Sound Absorbing Materials," by E. J. Evans and E. N. Bazley, which has been published for the Department of Scientific and Industrial Research by H.M.S.O., price 3s. The main section of the booklet consists of tables of the absorption coefficients of over three hundred materials. Both the materials and the method of mounting employed are described. The materials are classified broadly according to their physical characteristics, those of the same acoustical type being grouped together. The tables are accompanied by a discussion of the results. Recent developments in the design of sound absorbent materials are described as well as the various types and the physical processes involved.

OLDBURY NUCLEAR POWER STATION CONTRACT

The tender of Sir Lindsay Parkinson & Co., Ltd., amounting to approximately £2,200,000, has been accepted by the Central Electricity Generating Board for the circulating water system river works for the proposed nuclear power station at Oldbury, Glos. The contract includes the construction of a reservoir on the river foreshore and site preparation.

Information for the British Exporter

A second edition of the coloured wall map, "Information for the British Exporter," has been prepared for the Board of Trade by the Central Office of Information.

The map pinpoints every United Kingdom commercial post throughout the world, gives United Kingdom export and import figures for many individual countries and the proportion of the United Kingdom contribution to their total imports. The sterling, dollar, E.F.T.A. and O.E.E.C. areas are indicated by different colours and a list of national currency units and values is given.

The map, which is 40in wide by 30in deep, is again being distributed free to United Kingdom firms by the Regional Controllers of the Board of Trade.

MEM SWITCHGEAR for Neon Signs

M.E.M. Switchgear for Neon Lighting Installations complies with I.E.E. Reg. 713, for Fireman's Emergency Switches, and I.E.E. Reg. 712, for Locked Switches. The Switches are of Double Pole, quick make and break type, and are designed to break inductive loads to full rated capacity, in accordance with I.E.E. Reg. 702. Cases and covers are of cast iron, tapped one ¾" conduit top and bottom. A Gasket between case and cover makes the unit fully weatherproof.



215 AF
15 AMPS
250 VOLTS
Q.M. & B.

FIREMAN'S EMERGENCY SWITCH

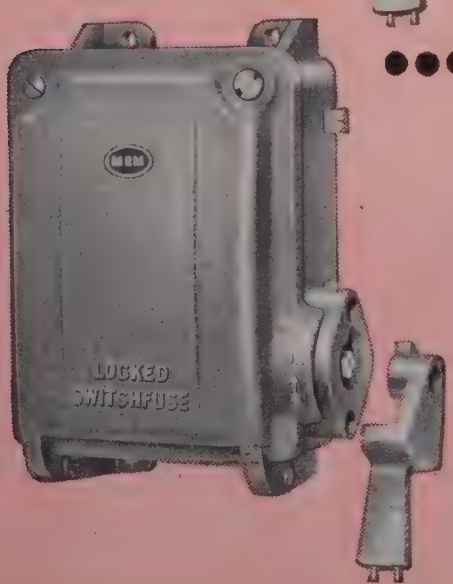
Has "OFF" position at the top and is provided with a spring loaded locking device which prevents accidental return of the switch from the "OFF" to the "ON" position.
Switch handle is designed for pole operation.
Finished in red stove enamel.



215 AS
15 AMPS
250 VOLTS
Q.M. & B.

LOCKED ISOLATING SWITCH AND SWITCHFUSE

Prevents restoration of supply by unauthorised persons.
Operating handles can only be removed when switch is in "OFF" position. The removable handle serves as a special key for unlocking the cover.
Switchfuses are available in Single Pole and Neutral and Double Pole patterns.



215 KS
15 AMPS
250 VOLTS
Q.M. & B.

Write for List No. 428 on M.E.M. Neon Switchgear.

MIDLAND ELECTRIC MANUFACTURING CO. LTD.
REDDINGS LANE, TYSELEY,
BIRMINGHAM, 11

HERE'S HOW

Osram is going to help

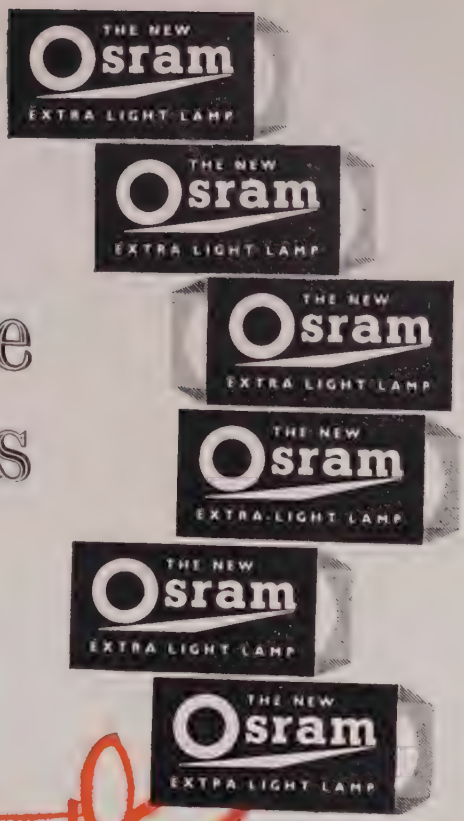


Starting January 9th

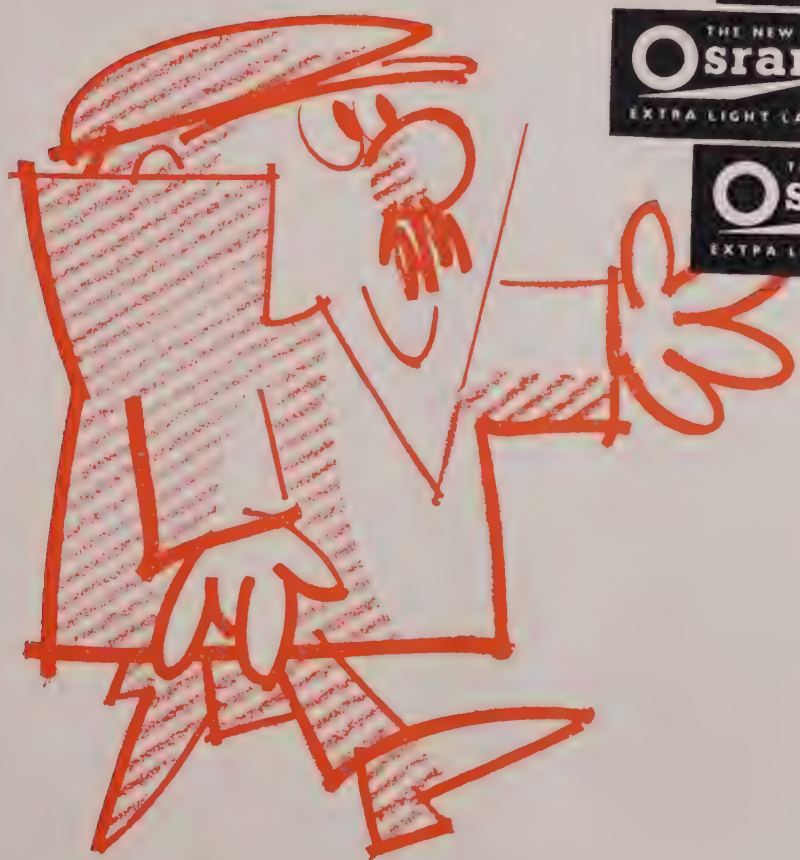
12 30-second commercials all at maximum audience times, from all ITV stations.

A series of advertisements every week throughout the television campaign in each of these national papers: Daily Express, Daily Mail, Daily Mirror.

Striking NEW showcards and window-banner.



you to sell more and more lamps



Make it a prosperous New Year with Osram

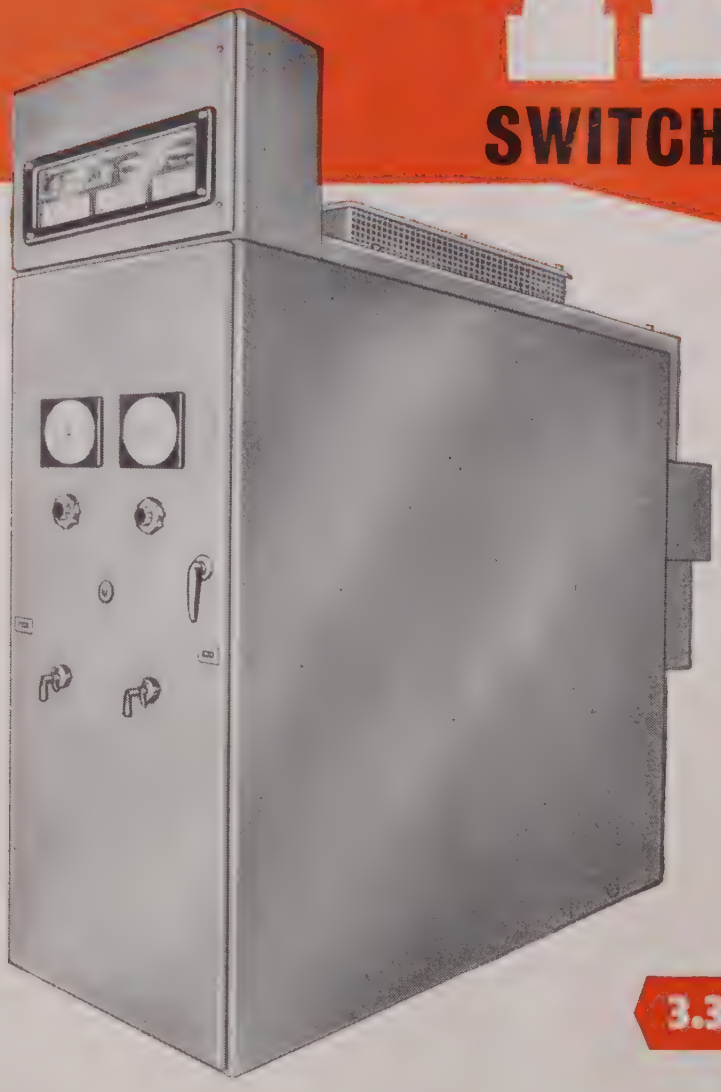
Make sure of your stocks NOW of the 100, 60, and 40 watt Osram Extra Light Lamp.

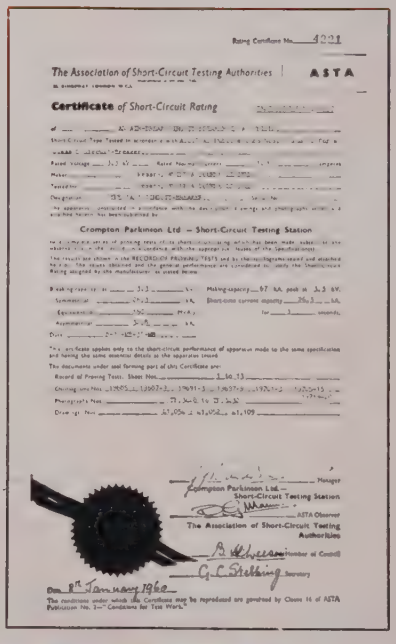
The General Electric Co. Ltd., Osram Lamp Division

Air Insulated Air Break

TYPE **AH**

SWITCHGEAR UNIT





3.3 kV. 150 MVA

"At Home" — Ashore or Afloat

The "AH" Switchgear Unit is air insulated and embodies an Air Break Circuit Breaker which has been certified for a Rating of 150 MVA at 3.3 KV in accordance with A.S.T.A. Requirements 16 and 18 and is suitable for both marine and land based installations.

WHIPP & BOURNE LTD.

CASTLETON • ROCHDALE • LANCASHIRE

INDUSTRIAL NEWS *[continued*

£3 Million Australian Contracts for A.E.I.

ORDERS worth £3 million have been obtained by Associated Electrical Industries, Ltd., in Australia. They include the largest thermal generating unit ever ordered for service in the Southern Hemisphere and transformers which will operate on the highest system voltage in Australia.

The orders have been placed by the Electricity Commission of New South Wales. The 275 MW generating unit, worth approximately £2 million, is for a power station at Vales Point, 70 miles north of Sydney. It will consist of a reheat turbine and a hydrogen cooled generator with water cooled stator windings.

The other contract is for 13 transformers worth £1 million. Seven of these will be rated at 133 MVA and will operate at 330 kV. The other six are rated at 60 MVA, 132 kV. The generating unit, due for commissioning in 1965, will be manufactured at Manchester and the transformers at Rugby.

The 275 MW, 3,000 r.p.m. turbine will use steam at a stop valve pressure of 2,300 p.s.i. at a temperature of 1,050°F and exhausting against a back pressure of 2in Hg abs. with cooling water at 75°F. It will have four cylinders and will be designed for seven stage feed heating to a final feed temperature of 485°F. The directly coupled a.c. generator, which will be rated at 305·555 MVA, 0·9 p.f., three-phase, 50 c/s, 16·5 kV, will have water-cooled stator windings and the rotor will be cooled by hydrogen at 30 p.s.i. For convenience of transport and erection the caged-core construction will be used and the outer casing will be in three sections.

The seven 133 MVA single-phase transformers are for Sydney North substation. They are auto-transformers with a bank ratio of 330/138·6/15·5 kV and will be connected in star to form two 400 MVA banks with one spare unit. The voltage ratio can be varied over a range of plus and minus 10 per cent in 20 steps by A.E.I. high-speed resistance transfer on-load tap changers. The transformers are oil filled and up to 60 per cent of their rating can be cooled naturally. Above this the natural cooling is augmented by oil pumps and air fans. When completed, each transformer will weigh about 175 tons. Shipment will take place in the first half of 1962.

The six 60 MVA three-phase transformers are for Bunnerong power station. They are double wound star/star delta connected with a voltage ratio of 132/33/11 kV and the high voltage can be varied on load over a range of 20 per cent in 16 steps. The transformers are oil immersed and with natural cooling will give an output of 65 per cent of full load rating. Above this the cooling is augmented by air fans. The total weight of each transformer is about 125 tons. They will all be dispatched during 1961.

Change of Name

The Leeds and Northrup Company of Philadelphia has acquired all the outstanding shares not previously owned by it in Integra, Leeds & Northrup, Ltd., the name of which has been changed to Leeds & Northrup, Ltd., as from 8th December. It is stated that the parent company intends to supply substantial additional capital to enable the company to build new works and offices and embark on a programme of development and expansion of its present plant and equipment to take advantage of the widening market in Great Britain for its electronic measuring and control instruments and heat treatment furnaces. Mr. J. W. Robinson, until recently president of Leeds and Northrup, Canada, Ltd., is joining Mr. J. J. A. Rogister as joint managing director.

Irish Cables Apprenticeship Scheme

In conjunction with the Newcastle (County Down) Technical School, Irish Cables, Ltd., have started a new five-year apprenticeship scheme under which selected applicants will be trained in all aspects of electric cable manufacture. Apprentices who successfully complete the five-year period will be eligible for key posts and staff appointments within the cable group, primarily as technical and test engineers, production supervisors, laboratory technicians, etc.

PRICE REDUCTIONS

The Electrical Division of Radiation, Ltd., announces that as from 1st January the "Jackson 202" 2 cu ft refrigerator has been reduced in price. The new price of the refrigerator, complete with legs and table top or wall mounting kit, is £25 3s 2d plus £4 14s 4d purchase tax.

Substantial reductions in the prices of their range of "Norbit" electronic sub-assemblies are announced by Mullard, Equipment, Ltd. The cuts range from 42 to 23 per cent.

Biggin Hill Church Floodlit

FOR the New Year St. Mark's Church, Biggin Hill, Kent, is being floodlit by equipment supplied by the General Electric Co., Ltd. A floodlighting technique developed by the company, and known as "designed appearance" lighting, was used to create light and shadow in planned positions, and so bring out the architectural features. St. Mark's is known as the "Moving Church" because in 1951 the Vicar, the Rev. Vivian Symons, with a small band of helpers, moved 125,000 bricks, 200 tons of stonework and all the roof timbers of a disused church at Peckham which they themselves had dismantled. The new church was then built to the designs of Mr. R. S. Gilbert Scott, A.R.I.B.A.

Wiring for the new floodlighting equipment was carried out by volunteers from the Electrical Trades Union. Switchgear was supplied by the South Eastern Electricity Board.



St. Mark's Church, Biggin Hill, showing the effective application of the "designed appearance" floodlighting technique developed by the G.E.C.

INDUSTRIAL NEWS *(continued*

NEW REMPLOY HEADQUARTERS

THE Minister of Labour, Mr. John Hare, formally opened the new head office of Remploy, Ltd., at Cricklewood, on 21st December. Close to the main office block, a new development shop has been erected which contains sections for woodworking, engineering, electrical and textile work as well as a laboratory and service department.

Designs for new products will be developed and prototypes made in the shop. The most serious difficulties likely to be encountered in production will be eradicated before a design reaches the factories, and accurate specifications and estimates produced.

The development shop will also provide testing and servicing facilities for goods being produced in Remploy factories, and examination of materials required for production.

There are 90 Remploy factories in England, Scotland and Wales, and the company provides productive employment for more than 6,300 severely disabled men and women.

Hotpoint Home Centre Opened

THE new Hotpoint Home Centre at 242/244, Oxford Street, London, W.1, was officially opened on Monday by the chairman of Associated Electrical Industries, Ltd., Lord Chandos, who was accompanied by Lady Chandos.

Situated conveniently near Oxford Circus, the Centre has a large demonstration area where the A.E.I.-Hotpoint range of domestic appliances, including the "Supermatic" and other washing machines, refrigerators, etc., is demonstrated in kitchen settings. An expert team of demonstrators headed by Mrs. Leslie Keir, a senior home economist of the company, are in attendance and members of the public are invited to take along their household problems.

There is also a lecture theatre and cinema, designed on the most modern lines, and local branches of the Electrical Association for Women and other organisations will be among invited audiences attending film shows, demonstrations and lectures in the theatre. The same facilities will be available to domestic appliance dealers and their staffs.

The Centre will also serve as a shop window for foreign buyers, a feature which is specially topical following the inauguration of a new drive for export business by Hotpoint's associated company, A.E.I.-Gala. Commenting on the drive, Lord Chandos said that the big scope for the future, as well as the national need, lay in overseas markets.

Hawker Siddeley and Petters

It is announced that Hawker Siddeley (Hamble), Ltd., will in future trade as Petters, Ltd., and will function as the Hamble Division of the company at Staines. Petters, Ltd., of Staines will continue to manufacture and sell diesel engines of 1½ to 108 b.h.p. and the Hamble works to manufacture and sell diesel generators, marine auxiliary sets, transport refrigeration equipment, etc., and will also provide Petter and Armstrong Siddeley spares and service, including the rebuilding of engines.

Mr. J. C. Dacombe has been appointed to the board of Petters, Ltd., as service manager, and Mr. T. D. Turner has also joined the board with the duties of general manager, Hamble works.

Prices of Materials

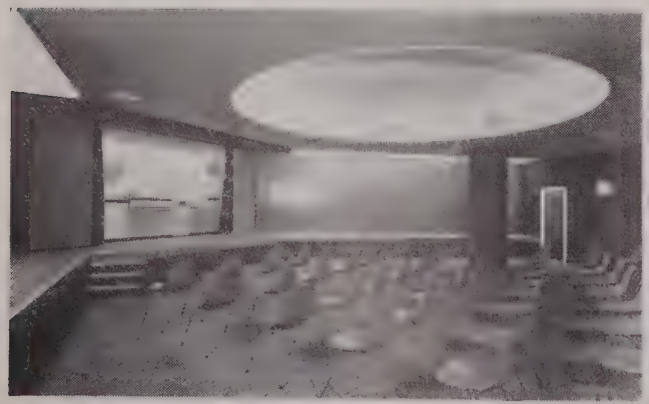
In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £186 0s 0d
COPPER, H.C. Electro	ton £227 10s 0d
Fire Refined 99·70%	ton £226 0s 0d
Fire Refined 99·50%	ton £225 0s 0d
COOPER Tubes ..	lb 2s 2¾d
Sheet	ton £263 5s 0d
H.C. wire and strip	ton £278 15s 0d
LEAD, English ..	ton £62 5s 0d
Foreign	ton £61 0s 0d
MERCURY	flask £70 10s 0d
TIN, block (English)..	ton £787 10s 0d
ZINC, G.O.B. Foreign	ton £78 15s 0d
BRASS Tubes (solid drawn)	lb 1s 10d
Wire	lb 2s 8¼d
PHOSPHOR BRONZE Wire	lb 4s 0¾d
PLATINUM ..	oz £30 5s 0d
RUBBER, No. 1 R.S.S. spot	lb 26½d—26¾d

MAIDSTONE FOOD STORE EXHIBITION

A special exhibition for food retailers in south-east England, which opens in Maidstone next Monday, will feature the increasing scope for refrigeration and specialised lighting as well as demonstrating polythene pre-packing of foods and automatic change computation and dispensing. The exhibition is being jointly organised by Philips Electrical, Ltd., the Frigidaire Division of General Motors, Ltd., the National Cash Register Co., Ltd., and Frederick Sage & Co., Ltd. It is planned as the first of a series for 1961 and will take the form of a completely fitted out self-service shop set up in the Corn Exchange.

The exhibition will be open from 3 p.m. till 7.30 p.m. on the first day, from 10.30 a.m. till 7.30 p.m. on the Tuesday, till 8.30 p.m. on the Wednesday and Thursday, and will close at 6 p.m. on Friday.





The lecture theatre of the new Hotpoint Home Centre is also equipped for film shows. Right: An exterior view of the building

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has appointed **Mr. F. Linley,** M.I.E.E., A.M.C.T., as deputy chairman of the North Western Electricity Board in succession to **Mr. T. Coates,** M.Eng., M.I.E.E., M.I.Mech.E., who has resigned on his appointment as general manager of the British Egg Marketing Board. Mr. Linley is manager of the No. 1 (Manchester) Sub-Area and has also been a member of the Board since 1959. He received his early training with W. G. Armstrong Whitworth and Crossley Motors and joined Manchester Corporation Electricity Department in 1923, becoming chief assistant mains engineer in 1944. On nationalisation he was appointed sub-area mains engineer to No. 1 (Manchester) Sub-Area. In 1953 he went to Board headquarters as purchasing officer, returning to No. 1 Sub-Area in 1954 as manager. Mr. Linley is this year's chairman of the North Western Centre of the Institution of Electrical Engineers.



Mr. F. Linley

The North Western Electricity Board has appointed **Mr. E. Kirkland,** A.M.C.T., A.M.I.E.E., as deputy chief engineer and **Mr. G. A. W. Riley,** A.I.M.T.A., A.C.I.S., as deputy accountant.

Mr. Kirkland joined the Manchester Electricity Department in 1927 as a testing assistant and at vesting date was assistant engineer (transmission). Since then he has held engineering appointments in the Board's North West District and at No. 1 Sub-Area headquarters. Before going to Macclesfield last year as acting district commercial engineer he had been in charge of the Organisation and Methods Section at Board headquarters. During the war he served in the R.A., R.A.O.C. and R.E.M.E. and was demobilised with the rank of major.

Mr. Riley, who was also with Manchester Corporation before nationalisation, was appointed section head (salaries, wages and superannuation) at Board headquarters in 1949, a post which was later designated assistant chief accountant (salaries and superannuation). Last year he became responsible for accountancy methods. During the war he served in the Intelligence Corps and the R.A.S.C. and held the rank of captain.

Mr. A. Potter has been appointed general sales manager of Lansing Bagnall, Ltd., **Mr. E. H. Wheeler** becomes export sales manager and **Mr. C. A. Barr** manager of the company's technical services division.

Mr. R. Lewis Stubbs, director of the Zinc Development Association, has been appointed director-general of the Lead Development Association and the Zinc Development Association, and will be responsible for the overall direction and expansion of the work of both organisations. The two Associations will continue to function separately, and general managers are to be appointed for both.

Mr. D. W. Payn, T.D., F.C.C.S., has resigned as general manager and secretary to the Lead Development Association and has taken up an appointment as secretary designate to the London Master Builders' Association.

Recently the turbine factory at the Rugby Works of Associated Electrical Industries, Ltd., was incorporated in the A.E.I. Heavy Plant Division and, with the adjacent buildings used for the manufacture and testing of large electrical machines, was re-named the Large Machine and Compressor Department. **Mr. J. D. Riddle,** formerly manager of the turbine factory, has been appointed manager of the new department, and **Mr. R. Evans,** formerly superintendent of large machine production in the heavy plant factory, has been appointed assistant manager.



Mr. J. D. Riddle



Mr. R. Evans

Air Vice-Marshal W. E. Oulton, C.B., C.B.E., D.S.O., D.F.C., has retired from the Royal Air Force after 32 years' service and is joining the board of E.M.I. Electronics, Ltd., as director responsible for Ministry work.

Mr. J. J. Gracie, C.B.E., on his retirement as director and general manager of the Witton Works of the General Electric Co., Ltd., was recently given a Persian carpet and Georgian silver as a token of the esteem in which he was held by his colleagues and friends throughout the company. Mr. Gracie spent some 34 years with the G.E.C. and went to the Witton Works in 1938. Mr. Arnold Lindley, who became



Left to right : Mr. R. N. Millar, managing director of the Engineering Group, Mr. Arnold Lindley, Mr. J. J. Gracie, and Mr. T. H. Kelsey, who succeeds Mr. Gracie as general manager at Witton

chairman of the company on 1st January, made the presentation.

Mr. Gracie has accepted an invitation to join the board of The Mint, Birmingham, Ltd. He has also been appointed agent in Birmingham to Arbuthnot Latham & Co., merchant bankers.

Mr. L. J. Garibaldi has been appointed manager of the Steam and Gas Turbines Division, English Electric Co., Ltd., Rugby, as from 1st January, on the retirement of **Mr. A. Friswell,** M.I.Mech.E., general manager of the Steam Turbine Division. Mr. Garibaldi, who has been contracts manager, Steam Turbine Division, Rugby, since 1955, will be responsible to the general manager, Rugby and Whetstone, for all commercial activities connected with turbines and for the co-ordination of policy in engineering, sales and contracts. Mr. Friswell, who is aged 60, is retiring at his own request. He joined English Electric in 1921 and was appointed general manager, Steam Turbine Division, in 1949.



Mr. L. J. Garibaldi

Four engineering appointments are announced by Marconi Instruments, Ltd. **Mr. A. G. Wray,** M.A.(Cantab.), A.M.Brit.I.R.E., becomes deputy chief engineer; **Mr. R. L. Gilbert,** Ph.D., M.A.(Cantab.), advanced product engineering manager, and **Mr. A. Haviland** and **Mr. D. R. Willis,** A.M.Brit.I.R.E., proprietary engineering managers responsible for the design and development of groups of products.



Mr. A. G. Wray

For the last four years Mr. Wray has been chief of the company's Advanced Development Group, responsible for the design and development of multi-channel microwave test equipment and atomic power instrumentation. He joined the company in 1944 and was appointed company physicist in 1952.

Dr. Gilbert joined the Engineering Department of the company in 1958 after three years as a geophysicist in the Dominion Observatory, Ottawa, and has been mainly concerned with instrumentation for the Hinkley Point atomic power station. In his new post he will be responsible for nucleonics, temperature scanning, and X-ray image brightening equipment.

Mr. Haviland has been with the company since its formation. For some time he worked in the Production Department, and in 1943 he was made chief of the Development Test Section, later taking charge of one of the company's engineering groups handling Government contracts and certain proprietary instruments.

Mr. Willis has had 21 years' service in the organisation. In 1952 he was seconded to the company's U.S.A. office for engineering duties and on his return, eighteen months later, he took charge of an engineering group responsible for electronic measuring instruments intended for large-scale production.

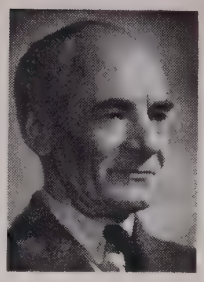
The annual dinner and dance of the Southern Centre of the **Institution of Electrical Engineers** was held recently at the Polygon Hotel, Southampton. The guests, who were welcomed by the Centre chairman, Mr. R. Goford, included Sir Robert Harvey, K.B.E., C.B., Deputy Director General of the G.P.O. Mr. Goford also paid tribute to the work of Mr. H. W. Housley, secretary of the Centre, who is retiring.

Replying to the toast of "The Institution," proposed by Sir Robert Harvey, Sir Hamish MacLaren (President, I.E.E.) spoke of the associations between the electrical engineering profession and the civil and mechanical engineering professions.

Viscount Weir, C.B.E., chairman of G. & J. Weir Holdings, Ltd., is giving up his position on the board of the principal subsidiary company, G. & J. Weir, Ltd., to devote more time to the overall administration of the group. **Mr. J. Russell Lang** takes over the position of chairman of G. & J. Weir, Ltd., and is succeeded as managing director by **Mr. J. W. Atwell,** M.Sc. The **Hon. W. K. J. Weir** is joining the board of G. & J. Weir, Ltd., as an additional director.

Mr. R. E. J. Putman, A.M.I.Mech.E., has rejoined James Gordon & Co., Ltd., as chief engineer, after having spent several years in England and Canada engaged in the application and development of electronic control equipment and systems for power stations, sugar factories, oil fields, etc.

Owing to ill-health, **Mr. R. Clarke,** O.B.E., M.I.Mar.E., has resigned from the board of Laurence, Scott & Electromotors, Ltd., of which he was marine sales director, after 48 years' service with the company. **Mr. J. B. Wormall,** M.I.E.E., formerly industrial



Mr. R. Clarke



Mr. J. Callf

sales director, is now sales director for all the company's products. **Mr. J. Callf,** who was the chief estimator of the Marine Department, has become marine sales manager and is succeeded by **Mr. B. Kidd.**

Mr. F. D. Pratt, personal assistant to Mr. G. S. C. Lucas, director and chief engineer, A.E.I. (Rugby), Ltd., retired on 23rd December after nearly 52 years' service. Mr. Pratt joined the British Thomson-Houston Co., Ltd., in 1909 as an apprentice and from 1921 to 1946 he served in the then Turbo-Generating Engineer's Dept., being responsible for mechanical design. In 1946 he was appointed executive assistant to Mr. P. D. Morris, chief turbine engineer; in 1957, personal assistant to the late Mr. K. R. Hopkirk, then chief mechanical engineer; and in 1959, personal assistant to Mr. Lucas. For many years Mr. Pratt has been very actively connected with various sections of the A.E.I. Recreation Club, Rugby. He was at one time secretary and business manager of the old B.T.H. Operatic Society and also played the tenor lead in such productions as "H.M.S. Pinafore" and "Princess Ida."



Mr. F. D. Pratt

Mr. W. J. Brown, M.I.E.E., F.P.I., technical manager of the Bushing Co., Ltd., has been appointed a director of the company. Mr. Brown served his apprenticeship at the Trafford Park works of the Metropolitan-Vickers Electrical Co. and spent ten years in the company's Research Department, engaged mainly on the investigation of insulation problems. He joined the Bushing Co. in 1935 as a development engineer and was appointed chief engineer in 1939 and technical manager in 1941.

Mr. M. Morris is retiring after 35 years as technical sales engineer in the Merseyside area for George Ellison,



Mr. M. Morris



Mr. L. C. Bentley

Ltd. He will continue to act in a consultative capacity until the end of May next. He is succeeded by **Mr. L. C. Bentley,** who has been with the company for 16 years, the last three as assistant to Mr. Morris in the Merseyside area.

The Birmingham Branch of the **Electrical Industries Benevolent Association** held its annual luncheon on 15th December at the Grand Hotel under the chairmanship of Mr. H. J. Bick. Mr. R. R. B. Brown, the Association's president, proposed the toast of the Birmingham Branch to which Mr. W. S. Lewis (chairman, Midlands Electricity Board) responded. The toast of the guests was proposed by Mr. R. L. Batley (regional director, Midlands Region, C.E.G.B.) and Mr. Andrew Cooper (member, C.E.G.B.) replied. The collection on behalf of the E.I.B.A. amounted to £226 10s, a sum which has been surpassed only once before in the Association's history —at its jubilee luncheon in 1955.

Mr. Stuart M. Rix, deputy chairman of the Southern Electricity Board, has been elected president of the Chartered Institute of Secretaries. He was deputy secretary of the British Electricity Authority from 1947 to 1955, when he was appointed to his present position. Previously he had been with the former Central Electricity Board and the Lancashire Power Co. Mr. Rix succeeds as president of the Institute another prominent member of the electricity supply industry—Mr. Ernest Long, a member of the Central Electricity Generating Board.



Mr. S. M. Rix

Mr. H. W. Buxton, assistant secretary (administration) with the North Western Electricity Board, is relinquishing that position in March to take Holy Orders. Mr. Buxton has been in the electricity supply industry since 1920 when he joined the Manchester Electricity Department. He has been a lay reader for sixteen years.

The expanding production of magnetic components in all fields of electronics has led to a re-grouping of the Component Division of Mullard, Ltd. The Division has now been subdivided, under its divisional head, **Mr. A. F. T. Marner,** into four commercial product groups. These are as follows:—Permanent Magnets: Manager, **Mr. B. C. Foreman.** Ferrites: Manager, **Mr. W. A. Everden.** Computers: Manager, **Mr. K. R. Patrick.** Radio and Television: Manager, **Mr. W. K. Bailiff.** Each product group will provide its own technical service, co-ordinated by **Mr. A. J. Tyrrell,** who retains overall responsibility for the technical services of the division.

Vice-Admiral Sir Norman Dalton, K.C.B., O.B.E., has taken up an appointment as technical consultant to J. Stone (Holdings), Ltd., and has joined the board of Epsylon Industries, Ltd. Both these companies are members of the Stone-Platt Industries group.

Viscount Ward of Witley, P.C., has joined the board of Richard Johnson & Nephew, Ltd.

Wild-Barfield Electric Furnaces, Ltd., have made a number of appointments, all of which have been filled from within the company, under a reorganisation scheme to cope with expanding business. They are: Executive manager (engineering), **Mr. W. R. Brew;** executive manager (commercial), **Mr. F. L. Gladwin;** executive manager (production), **Mr. O. V. Metcalfe;** and sales manager, **Mr. R. C. Ray.**

Mr. Brew started with the company in 1934 as a student apprentice and was appointed home sales manager in 1946 and sales manager shortly afterwards. Mr. Gladwin commenced his career with the Fuller Electrical & Manufacturing Co., Ltd., as a technical assistant in the Welding Sales Department, and in 1937 took up a similar post with G. D. Peters & Co., Ltd. He later went to the Arc Manufacturing Co., Ltd. (subsequently taken over by Wickman, Ltd.), and was seconded to Applied High Frequency, Ltd., as technical sales manager. When the latter company was acquired by Wild-Barfield in 1955 Mr. Gladwin was appointed sales manager, Induction Heating Division. Later his responsibility was increased to take in the Vacuum Division. Mr. Metcalfe served his apprenticeship with Bull Motors and after spending some time in the London Electric Railway Signal Division he joined Wild-Barfield in 1933 as assistant works manager, being appointed works manager in 1938. Mr. Ray started in the Wild-Barfield design and drawing office in 1937 and after war service in the R.A.F., during which he was awarded the D.F.M., he rejoined the company and moved to the sales office of which he was appointed manager in 1957.

Mr. P. R. Armitage, A.M.I.Loco.E., has been appointed manager of the Traction Division of the General Electric Co., Ltd., in succession to Mr. W. D. Morton, whose promotion to assistant general manager of the Witton Works was announced recently. Born in Birmingham in 1926, Mr. Armitage was educated at Kings Norton Grammar School and the Birmingham College of Technology. He joined the company in 1942 as an apprentice and was appointed a traction control engineer in 1946. Mr. Armitage has spent the whole of his time in the Traction Division and has worked in the Control Department and in the Sales and Contracts Department.



Mr. P. R. Armitage

The Harland Engineering Co., Ltd., announces the appointment of **Mr. A. C. Wood-Parker,** B.A.(Oxon), C.A., as a director of the company.

Mr. R. H. Thornicroft has been appointed manager, Traffic Department, A.E.I. (Rugby), Ltd. He succeeds **Mr. G. O. Pritchard** who relinquished the position on 31st December but who is remaining in the service of the company for a time in a consultative capacity.

At the end of 1960 **Mr. John Bailey** relinquished the position of sales director of Brook Motors, Ltd., which he had held for many years. He will, however, remain on the board as a technical consultant. From 1st January, **Mr. David Brook** has taken up the position of sales director for the home market. Apprentice-trained by the company, he occupied an executive position before being co-opted on to



Mr. David Brook

the board in 1958. He was educated at Oundle and was commissioned in the Royal Electrical and Mechanical Engineers. **Mr. G. H. Brook** becomes sales manager.

Mr. J. Firmin has been appointed to the board of the Sun Electrical Co., Ltd. Mr. Firmin has been with the company since 1931, and in 1951 was made manager of the Guildford branch. In 1957 he was appointed a delegate director responsible for branch administration.

Mr. R. W. Dowsett, Associate I.E.E., has been appointed a director of M.K. Electric, Ltd., as from 2nd January. Mr. Dowsett, who joined the company over 36 years ago, is deputy general manager and has been an executive director since 1944.

Mr. L. Harvey, M.I.E.E., who since 1949 has been Ayrshire Area engineer of the South of Scotland Electricity Board, has been appointed manager of the Glasgow Area. Mr. Harvey received his training with the Leeds Corporation Electricity Department and subsequently held various positions with the Yorkshire Electric Power Co., Electrical Distribution of North Wales & District, Ltd., and the North Wales Power Co. On nationalisation he was appointed sub-area construction engineer with the Merseyside and North Wales Electricity Board.



Mr. L. Harvey

Mr. S. G. Elliott-Smith, managing director of Cryselco, Ltd., retired on 31st December after 40 years with the company. He served in the Merchant Navy and Royal Flying Corps in the 1914-18 war and joined Cryselco, Ltd., in 1920. He was appointed assistant sales manager in 1930, sales manager in 1944 and managing director in 1956.



Mr. S. G. Elliott-Smith

Mr. L. Rumley has been elected president of the British Industrial Truck Association for 1961. He is sales director of Conveyancer Fork Trucks, Ltd., Electro-Hydraulics, Ltd., and Conveyancer - Scott Electric Vehicles, Ltd.

Mr. C. W. Villiers, who joined Morphy-Richards as purchasing manager when the company was first established 24 years ago, has been appointed to the board of Morphy-Richards (Cray), Ltd. He retains executive responsibility in charge of the Purchasing Division.



Mr. C. W. Villiers

Four executives of Crofts (Engineers), Ltd., have been appointed sectional directors. They are **Mr. H. Goldthorpe,** works director; **Mr. C. Mason,** branch works director; **Mr. A. Hearn,** production control director; and **Mr. S. W. Ball,** foundry control director.

After 21 years as secretary of the North-East Coast Institution of Engineers and Shipbuilders, **Mr. T. S. Nicol** has retired.

Mr. S. M. Smith, who joined the Scull organisation to manage Scull Electrical, Ltd., on its formation in 1959, has been appointed to the board of Arthur Scull & Son, Ltd., as an associate director. He has also been promoted to the position of managing director of Scull Electrical, Ltd.

Mr. F. H. Dale has been appointed assistant manager, Military Radar Sales Department, A.E.I. Electronic Apparatus Division.

Edmundsons (Midlands), Ltd., which was formed last year to take over the businesses previously carried on as F. Westerman (Wholesale), Ltd., and Electro-Mechanical Supplies, Ltd., has appointed **Mr. A. W. Stone** as accountant.

OBITUARY

Mr. Frank E. Goff, chief buyer of S. N. Bridges & Co., Ltd., and the longest-serving member of the company's staff, died on 21st December at the age of 65.

Mr. A. C. Goodall, who had been manager for the past seven years of the sales division of Remploy, Ltd., marketing tubular sheathed electric elements, died suddenly on 14th December.

Mr. E. C. Linay, M.I.E.E., manager of the Sleaford District of the East Midlands Electricity Board, died in Grantham Hospital on 30th December. He was 65. After service with the Kings Lynn, Worksop and Chesterfield Corporation electricity undertakings he was appointed chief engineer and manager of the Sleaford U.D.C. Electricity Department in 1934 and became manager of the Sleaford District of the East Midlands Board at vesting date.

WILLS

Sir Cecil Weir, K.C.M.G., K.B.E., chairman of International Computers & Tabulators, Ltd., who died on 30th October, left £36,688 gross (£28,536 net).

The Earl of Verulam, chairman of Enfield Rolling Mills, Ltd., and the Engineering & Lighting Equipment Co., Ltd., who died on 13th October, left £17,398 gross (£15,969 net).

Mr. A. E. Hollings, managing director of Dowding & Mills, Ltd., who died on 23rd September, left £89,812 gross (£86,534 net).

Lord Weeks, K.C.B., C.B.E., D.S.O., a director of Associated Electrical Industries, Ltd., and other companies, who died on 19th August last, left £84,110 gross (£51,416 net).

Mr. W. G. Martin, overseas manager of A. Reyrolle & Co., Ltd., died on 14th August last, leaving personal estate in England and Scotland valued at £23,239.

Mr. R. O. Allston, joint general manager of the Ever Ready Co. (Great Britain), Ltd., who died on 3rd April, left £14,174 gross (£13,972 net).

SOVIET INDUSTRIAL DIGEST

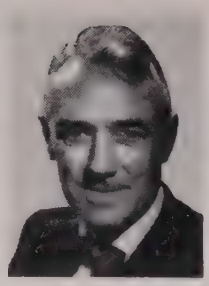
The first issue of the journal *Soviet Technology Digest* was published in December by the Pergamon Press, Ltd., Headington Hill Hall, Oxford, containing translated extracts from the Russian technical press announcing recent developments in the Soviet Union and Eastern Europe. The first edition includes sections covering design and production, metallurgy, instruments and automation. In addition, there is a general section dealing with such subjects as electro-slag welding of cast iron, the development of welding production in China and a number of book reviews. The magazine will be issued monthly, each issue containing approximately 100 pages, and the annual subscription rate is £10.

PLASTICS REPORT

The 13th report in a series on plastics, recently published by the Ministry of Aviation (H.M. Stationery Office, 5s), deals with the effect of tropical exposure on the physical and electrical properties of standard types of polystyrene mouldings. Twelve batches of mouldings were exposed for two years at five sites in Nigeria. The greatest fall in impact strength and the greatest deterioration of electrical properties were found in specimens exposed to sunlight. Impact-resistant materials showed greater deterioration in electrical properties than the others at all sites.


Dr. C. Dannatt


Mr. E. R. Lewis


Mr. W. T. Gemmell


Mr. J. R. Pheazey


Mr. J. B. Scott


Mr. A. J. Young

NEW YEAR HONOURS

Awards to Electrical Men

OUTSTANDING "electrical" names in the list of New Year Honours published last week-end are those of **Dr. C. Dannatt,** vice-chairman of Associated Electrical Industries, Ltd., and **Mr. E. R. Lewis,** chairman of the Decca Navigator Co., Ltd., and Decca Radar, Ltd., who have been made knights bachelor. In addition to these, the services of a number of other men in the electrical and allied industries have been recognised by appointment to the Order of the British Empire or the award of the British Empire Medal as shown below:—

Commander (C.B.E.)

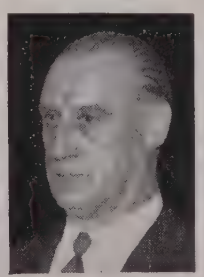
Mr. W. T. Gemmell, director, Midland Region, G.P.O.; Mr. J. R. Pheazey, vice-chairman and joint general manager, Standard Telephones & Cables, Ltd.; Mr. J. B. Scott, sales director, Crompton Parkinson, Ltd.; Mr. A. J. Young, managing director, English Electric Valve Co., Ltd.; Mr. R. H. Jones, chief electrical engineer, Crown Agents for Overseas Governments and Administrations; Mr. C. W. Goodman, chairman and managing director, English Electric Co. of Australasia Pty., Ltd.; and Mr. T. A. Housley, general manager, Overseas Telecommunications Commission (Australia).

Officer (O.B.E.)

Mr. H. W. Baker, superintendent engineer, Television London Studios, B.B.C.; Mr. W. N. C. Clinch, controller, Eastern Division, C.E.G.B.; Mr. S. J. Emerson, H.M. Senior Electrical Inspector of Factories; Mr. F. W. J. Gale, managing director, S. G. Brown, Ltd.; Mr. S. J. Giffen, senior assistant telecommunications controller, Northern Ireland, G.P.O.; Mr. W. R. Harvey, manager, Marine Department, Babcock & Wilcox, Ltd.; Mr. G. D. Ireland, chief engineer, Windscale and Calder Works, United Kingdom Atomic Energy Authority; and Mr. E. V. Andlaw, electrical engineer, Gibraltar City Council.


Mr. H. W. Baker


Mr. W. N. C. Clinch


Mr. S. J. Emerson

Member (M.B.E.)

Mr. F. Baker, assistant works manager, A. Reyrolle & Co., Ltd.; Mr. R. E. C. Brown, assistant chief engineer, Telephone Apparatus Department, Associated Electrical Industries, Ltd.; Mr. R. B. Dickinson, executive engineer, G.P.O.; Mr. J. C. Gale, director and sales manager, Petters, Ltd.; Mr. F. J. G. Haines, engineer-in-charge (sound), Cardiff, B.B.C.; Mr. E. V. Hardaker, divisional electrical engineer, Midlands Division, C.E.G.B.; Mr. J. G. Heaps, chief of test and


Mr. F. W. J. Gale


Mr. E. V. Hardaker


Mr. J. G. Heaps

inspection, Ferranti, Ltd., Wythenshawe; Mr. F. E. Huckfield, assistant engineer, Telephone Manager's Office, Gloucester; Mr. J. T. Jackson, group works engineer, Joseph Lucas, Ltd.; Mr. E. W. Raby, lately deputy chief accountant, Yorkshire Electricity Board; Mr. L. J. V. Reynolds, assistant repair manager, John I. Thornycroft, Ltd.; Mr. W. L. Roe, chief metallurgist, Aiton & Co., Ltd.; Mr. C. Sanders, senior experimental officer, Atomic Energy Research Establishment, Harwell; Mr. F. Smedley, district engineer, Bathgate District, South of Scotland Electricity Board; Mr. C. J. Syvret, lately engineer-manager, States of Jersey Telephone Department; Mr. R. G. Taylor, general manager, C. & N. (Electrical), Ltd., Gosport; Mr. J. W. Morison, lately general manager, Electricity Authority of Cyprus; and Mr. J. W. Murray, chief engineer, Nigerian Broadcasting Corporation.

British Empire Medal (B.E.M.)

Mr. J. Carter, assistant foreman, Associated Electrical Industries (Manchester), Ltd.; Mr. W. Cullen, chargehand fitter, Barton Power Station, C.E.G.B.; Mr. E. J. Easter,

lately technical officer, Engineering Depot, G.P.O., King's Lynn; Mr. R. Goodwin, foreman, Newton Bros. (Derby), Ltd.; Mr. C. E. Hutcheson, chargehand electrical fitter, Ministry of Works; Mr. H. F. Jack, district senior commercial officer (agriculture), North of Scotland Hydro-Electric Board; Mr. W. H. Johnson, foreman turbine driver, Walsall Power Station, C.E.G.B.; Mr. W. S. Kirkbright, foreman, Southall Sub-Area Construction Department, Southern Electricity Board; Mr. C. Maddison, technical officer, Telephone Manager's Office, G.P.O., Newcastle-upon-Tyne; Mr. T. C. H. Miles, fitter, Elliott Bros. (London), Ltd.; Mr. A. Miller, leading stoker, Grimsby Power Station, C.E.G.B.; Mr. A. Mills, meter chargehand, Mid-Sussex Sub-Area, South Eastern Electricity Board; Mr. L. R. Sparks, technical officer, P.O. Research Station, Dollis Hill; Mr. A. Wooldridge, technical IIa jointer, Victoria Telephone Exchange, G.P.O.; and Mr. W. F. Young, radio technician, R.A.F., North Weald.

LARGE ARC MELTING FURNACES

ORDERS to build four electric arc melting furnaces have been received by G.W.B. Furnaces, Ltd., as part of Steel, Peech & Tozer's £10 million development programme including two furnaces ordered a year ago. The total output of the finished plant will be 1,135,000 ingot tons of steel a year.

Each of the four furnaces will have an electrical rating of 40,000 kVA. The furnaces will have a nominal capacity of 150 tons, but they will be worked with a 110 ton charge using a shallow bath, with a large surface area. The weight of the electrode-supporting structure will be permanently carried by a gantry which, after raising the roof, is swung aside by an a.c. motor through a train of gears to allow furnace charging. The shell and gantry will be mounted on a steel platform supported by three arc-shaped rockers which allow the furnace to tilt forward 45° for pouring and backward 15° for slagging. The drive for tilting the furnace will be controlled through Ward-Leonard sets by two d.c. motors through gear trains to pendant pin racks attached to the underside of the furnace. The shell will be arranged to rotate 40° either side of the normal electrode position which allows drilling of the scrap if so desired in three positions for each electrode.

These furnaces will be installed having interleaved heavy current connections from the transformer outgoing terminals to the point where the delta connection is made at the electrode clamps. Water-cooled flexible cables will be employed to carry the heavy phase currents from the transformer to the water-cooled bus tubes carried by the electrode arms. To obtain maximum interleaving and balancing of electrode currents in each phase, four-electrode mast construction will be employed. The two outer masts will carry electrode arms which support the outer electrode, the arm movements being synchronised. Balancing of the three electrode currents will ensure even wearing of the shell refractory, greater stabilisation of the three arc currents and reduce the reactive MVA swing presented to the electricity supply system. The effect of interleaving the heavy current connection will also reduce the percentage voltage reactance, so improving the power factor.

To ensure stable arc conditions, which are necessary to achieve the highest possible working power factor, electrical efficiency and minimum kWh per ton to melt the steel, the mechanical construction of the furnace platform gantry and electrode-supporting mast structure have been designed to enable the use of a high-speed, high response rate, hydraulic electrode control regulator. Interleaving the heavy current connections, and so reducing the reactance of this circuit, makes it essential to employ high-speed electrode control to achieve a high working power factor during the breakdown period of the melt.

Power for each furnace will be derived from a 40 MVA transformer employing on-load resistor bridging type tap-changing equipment. The transformer will consist of two basic units, a tapped auto feeding a double-wound straight ratio unit. The heavy current terminations will be made by bringing out a number of connections in parallel and interleaved for each of the three phases, connections being brought out from the windings through the side of the transformer tank. Transformers will employ forced oil cooling through an externally mounted water-cooled heat exchanger. The primary winding will be suitable for connection to a 33 kV, three-phase, 50 c/s supply and the maximum arc voltage will be 565 V.

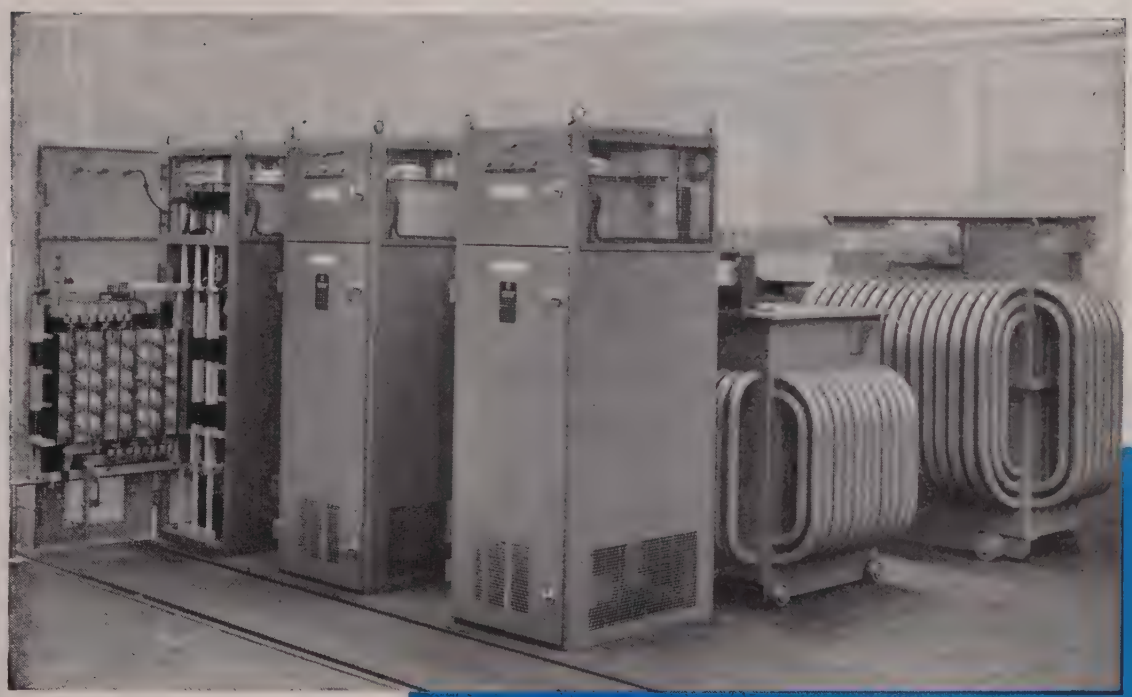
Divertor Current Measurement

THE well-known method of surge current recording by magnetic links has become more reliable since the steel links originally used have been replaced by ferrite links and this method is particularly appropriate where surge currents are rare events. Of the multitude of links installed on German power systems, those used for the supervision of the responses of surge divertors are considered. They have been used for this purpose since 1950. There were 84 indications of atmospheric surges analysed, 60 per cent due to currents below 1 kA and three cases due to currents of 4·2, 5·6 and 7·5 kA, respectively. The last of these was set up by a lightning current in a tower of the extremely high value of 200 kA, at only 1 km from the divertor. Since all the individual phase divertors operated in this case, no damage was caused. The recording of switching surges was not so complete as that of lightning surges, probably because the links are checked, as a rule, only after thunderstorms. However, some earth faults, single and double, were confirmed by link measurements. In the majority of switching surge cases the currents are below 100 A, which is the minimum value that can be recorded by links. Where the divertors were destroyed (five cases) after double earth faults, the currents recorded were 1-5 kA (probably the fault currents after the destruction of the divertor).—"Measurement of the Current to Earth of Valve-Type Divertors by Magnetic Links," H. Maier, *Elektrotech. Z. (ETZ) A*, Vol. 81, pp. 630-632, in German.

E C C

POWER RECTIFIERS

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GERMANIUM
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AC TO DC ★
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2000 AMPERE 110 volt GERMANIUM RECTIFIERS

★*Our Specialist Engineers will be pleased to advise on YOUR problem.*

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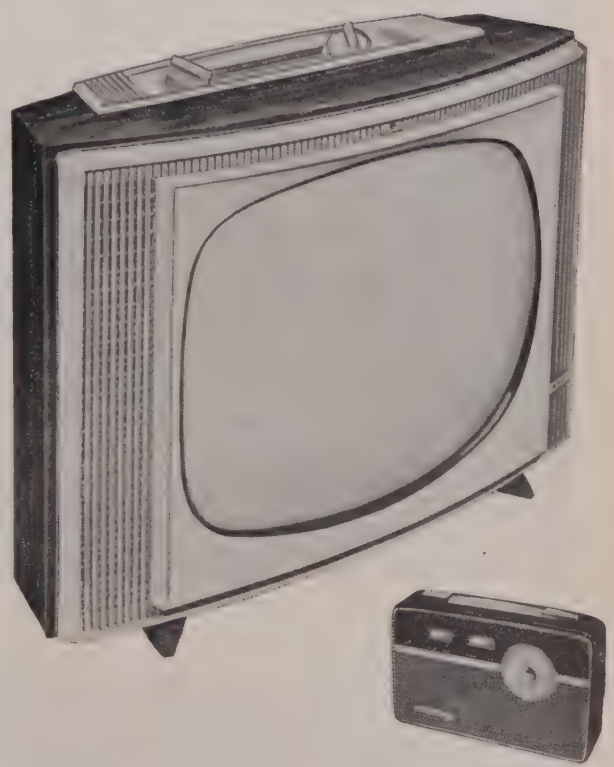
We've come a long way since the crystal set era.
V.H.F., frequency modulation, stereo, big screen television — constant developments
in the air create a constantly growing market. It pays to advertise
to this market on television — a fact endorsed by the dealer himself.
In a recent survey commissioned by Associated-Rediffusion,
dealers mentioned television as being more successful
than any other medium in helping them sell more television sets.
In addition, more and more people are buying replacement television sets on styling.
There is no better medium than television for actually demonstrating
your model or a particular feature of its design.



An early valve receiver. 1923

Look at the size of the replacement market for television sets in the London area covered by Associated-Rediffusion. Nearly half of the homes viewing Independent Television have sets three years old or more. The following table shows the breakdown in detail.

	AGE OF PRESENT SET	TOTAL
Base of %—No. of informants		2088
Percentage who had present television set	Three years	14%
	Four years	12%
	Five years or more	18%



There is no better medium than television for driving home your sales message in the face of increasing competition. Manufacturers of all electrical goods advertising on Associated-Rediffusion can reach over 8 million people in their homes, in London. This represents a prosperous mass market in an area where there is a huge replacement trade waiting to be developed. Advertise on television in London — on Associated-Rediffusion.

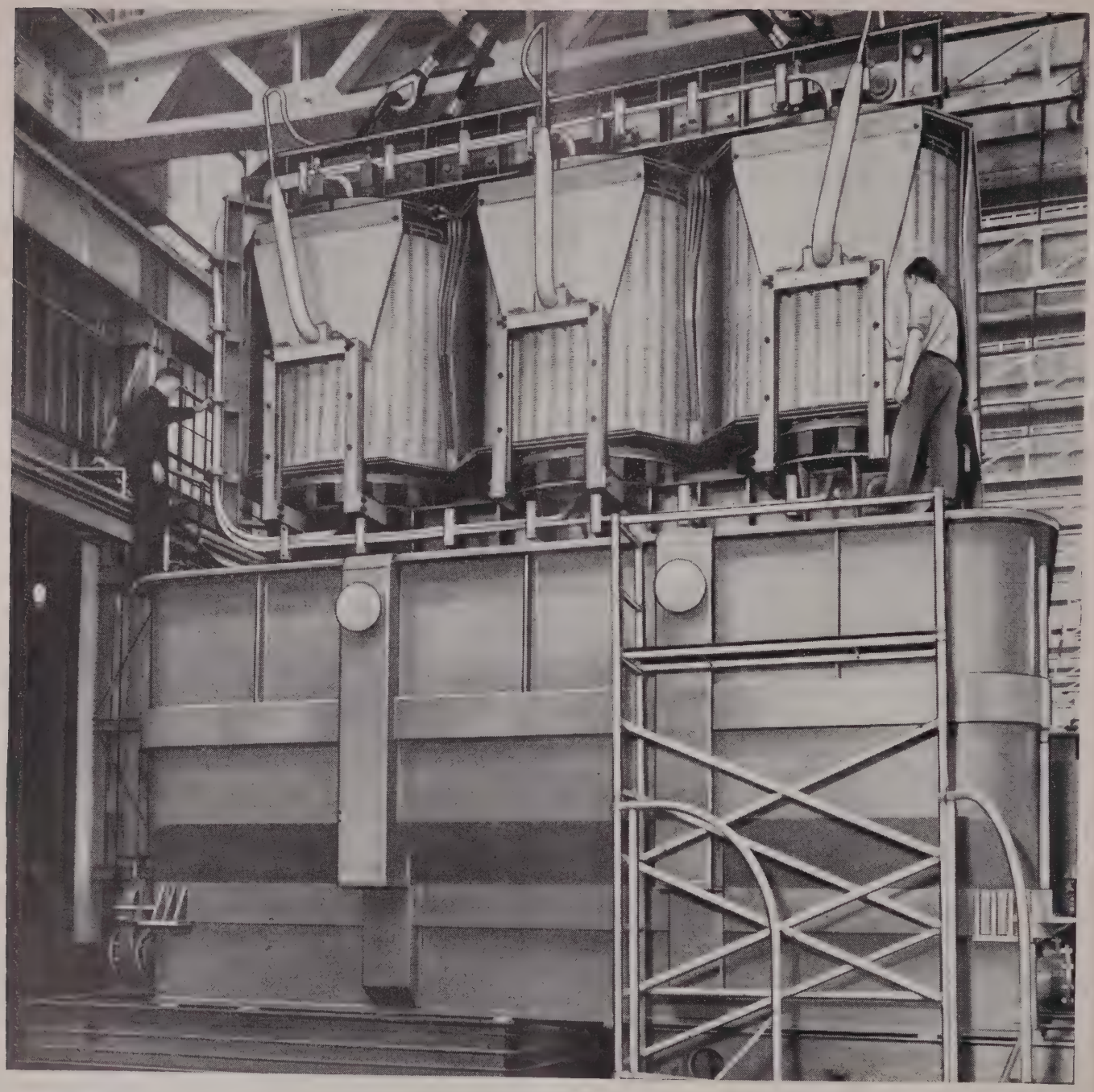
The above figures are quoted from the London Viewership Survey No. 4, commissioned by Associated-Rediffusion. John Talbot (HOLborn 7888) will be pleased to let you have full details.

LONDON

ASSOCIATED-REDIFFUSION

London's Television, Monday to Friday

Television House, Kingsway, London, W.C.2. Tel: HOLborn 7888
also Norfolk House, Smallbrook, Ringway, Birmingham 5. Tel: Midland 9151/2
and Peter House, Oxford Street, Manchester 1. Tel: Central 9867/8



HACKBRIDGE TRANSFORMERS

The core and coil assembly of a 180 MVA 275/132 kV type ON/OFB auto transformer being lowered into its tank.

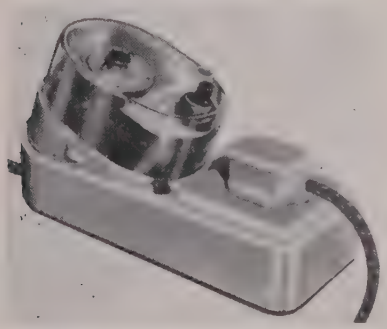
LARGEST SIZES
HIGHEST VOLTAGES

HACKBRIDGE AND HEWITTIC ELECTRIC COMPANY LIMITED
HERSHAM WALTON-ON-THAMES-SURREY Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: Electric Walton-on-Thames

NEW ELECTRICAL EQUIPMENT

Portable Time Switch

The "Autopoint" time switch introduced by VENNER, LTD., Kingston By-Pass, New Malden, Surrey, is designed to operate regularly each day, if required, without the need for resetting. Basically, the unit consists of a combined time switch and 13 A socket outlet mounted on an ivory plastic base with an easily removable clear plastic cover. Two switching periods can be set every 24 hours and the minimum period between on and off is 30 minutes. Manual control enables an appliance to be switched on or off independently of the dial setting.



Venner "Autopoint" portable time switch

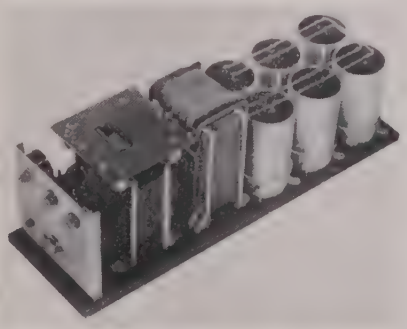
The unit is fitted with rubber feet and can be used anywhere in the home —to control heaters, electric blankets, defrosting refrigerators, etc. It measures 9¾in by 4in and the overall depth is 5¼in. The price, including 1½ yd of 3-core flexible, is £5 17s 6d.

Industrial Heating Triodes

Water-cooled valves, types 3Q/202E, 3Q/222E and 3Q/232E, designed for use in r.f. heating and communication equipment with typical outputs (Class C, unmodulated) of 12, 25 and 24 kW respectively are now available from STANDARD TELEPHONES & CABLES, LTD., Connaught House, Aldwych, London, W.C.2, with integral coiled water jackets under the codes 3R/202E, 3R/222E and 3R/232E respectively. The required water flow is less than for the corresponding Q version. Air- and vapour-cooled versions of these valves are also available.

Stabilised D.C. Power Supply

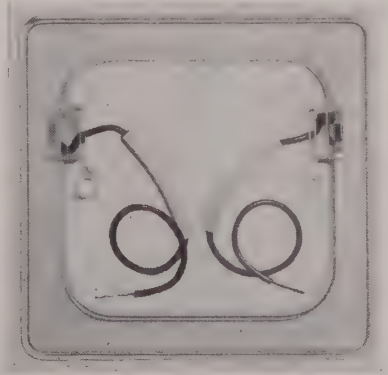
The Series PST stabilised d.c. power supply units announced by CLAUDE LYONS, LTD., Valley Works, Hoddesdon, Herts., consist of a conventional d.c. power supply (step-down transformer, bridge rectifier and reservoir capacitor smoothing), the input to which is fed through a transductor. A transistorised feedback amplifier measures the output voltage from the supply and continually adjusts the d.c. current in the control winding of the transductor to maintain the output voltage constant over a wide variation in input voltage and frequency, and in output current. Ripple is of the order of 1 per cent and the output voltage is adjustable over a range of ±15 per cent about the nominal value. Models available have nominal output voltages of 12, 20, 24, 32 and 48 V at output currents of 8, 5, 4, 3 and 2 A respectively. All models are available for chassis mounting or standard 19in rack mounting.



Claude Lyons stabilised d.c. power unit

Luminous Switch Surround

A luminous surround for light switches and similar fittings to aid location in the dark has been produced by M.K. ELECTRIC, LTD., Shrubbery Road, London, N.9. It is in the form of a transparent moulded frame which fits between the wall and the plate of any flush accessory having a plate of 3⅜in square and accommodated in a flush box having two fixing screws at 2⅜in centres. In darkness the "Locator" emits a bright green electroluminescent glow around the accessory, while in daylight it is ivory coloured and the frame serves as a finger-shield. The surround is provided with two connecting leads including resistors which are connected across the line and neutral terminals. The current consumption is negligible and its life is said to be indefinite. The price is 5s 8d.



M.K. Electric luminous switch surround

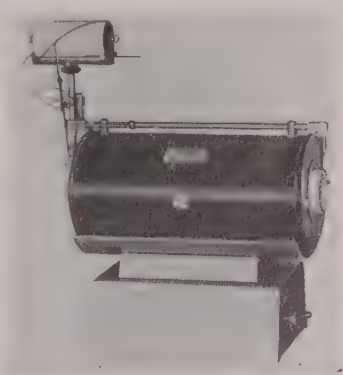
Laboratory Furnaces

A range of laboratory furnaces with high temperature stability (±0·25°C), an interchangeable drum control for thermal cycling, and facilities for heat loss compensation at the ends of the tube, have been introduced by the SHANDON SCIENTIFIC CO., LTD., 6, Cromwell Place, London, S.W.7. In the standard range there are three models for maximum temperatures of 1,050°C (one for operation at 115 V and two at 220 V a.c.), two models for maximum temperatures of 1,250°C (one 115 V and one 220 V) and two special models for maximum temperatures of 1,500°C for use on both voltages.

The standard models may be controlled either by a thermostatic regulator or a chronograph drum for thermal cycling, these arrangements being interchangeable.

The thermostatic regulator consists of a graduated scale and a pointer operated by a dilatable wire running through the furnace body. The scale is fitted with a stop which may be set to any desired temperature. When the pointer reaches the stop, the supply to the windings is automatically cut off by an 8 V relay.

The chronograph drum carries a temperature chart on which the desired thermal cycling programme is marked by a strip of thick cardboard.



Furnace with chronograph drum control (Shandon Scientific Co.)

As the furnace temperature rises, a contact on an arm connected to the dilatable wire moves across the drum. When it meets the cardboard, the relay operates and the supply is cut off. The contact follows the edge of the cardboard strip, alternately making and breaking the windings circuit, and holding the temperature to the planned programme.

The three separate windings are mounted along the tube, controlled individually by shunt rheostats, enabling the temperature to be varied along the tube.

Prices are from £95, according to model.

Contact Making Voltmeter

A contact making electrostatic voltmeter has been produced by NALDER BROS. & THOMPSON, LTD., 97, Dalston Lane, London, E.8. Applications of this instrument include the monitoring of battery circuits where a relatively high voltage (500 V) must be maintained and no measurable load can be tolerated, for high voltage testing of capacitors to a predetermined voltage and for use as an earth leakage indicator and relay for fully insulated d.c. or a.c. distribution systems. The instrument contacts, which in the case of over- or under-voltage control can be adjusted externally, are relieved from current carrying by incorporating them in the grid circuit of an associated valve amplifier, the main tripping or alarm current being carried by plug-in solenoid relays. The operational limits are from 100 V to 15 kV.

Domestic Refrigerators

Three new additions to their "Slimline" range of refrigerators have been announced by the ENGLISH ELECTRIC CO., LTD., English Electric House, Strand, London, W.C.2. They are 6, 7·7 and 9·4 cu ft models and a special feature of these is that each has a full-width, deep-cold freezer. Frozen foods can be kept for three weeks and even longer periods if precautions are taken with the food while defrosting the refrigerator.



English Electric "Slimline 60" 6 cu ft refrigerator

With a white exterior, and an interior colour scheme of glacier and arctic blue, the new models continue the "Slimline" theme of square-cut design—minimum overall measurements combined with the maximum internal storage space. All are fitted with an interior light and the two larger models have automatic push-button defrosting.

The respective measurements (height, width and depth) are 41½ by 22½ by 25⅝in ("Slimline 60"); 46½ by 24 by 27½in ("Slimline 77"); and 54 by 24 by 27½in ("Slimline 94"). Each model is guaranteed for one year with a five-year guarantee on the compressor type refrigerating unit. The prices, including purchase tax, are £84 9s, £109 and £125 respectively.

EXCESS DEMAND WARNING SYSTEM

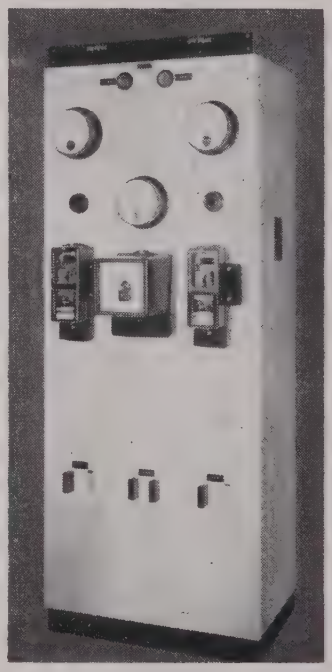
A warning system introduced by FERRANTI, LTD., Hollinwood, Lancs., has been developed primarily for use in plants of the continuously operated type where shut-downs based upon too frequent warnings of approaching maximum demand can affect product quality and the plant's efficiency.

The system maintains a continuous watch over the energy consumed during each successive demand period and compares it with an ideal load set by the user. The difference between the actual load and the ideal load is displayed on a 6in dial indicator and when the energy consumed by the actual load exceeds that of the ideal load by a predetermined amount a pair or pairs of alarm contacts close.

The discrepancy indicator is a ratiometer type instrument arranged so that the pointer remains on zero when the integrated loads are equal, moves to the left when the actual load is below the ideal load and to the right when it exceeds the ideal load. The state of the ideal/actual energy consumed can be seen on the discrepancy indicator at any time during each demand period and, depending on the time of viewing and the relevant load conditions, arrangements can be made to shed a part of the load.

The system operation is based on the binary storage of impulses by a chain of relays. Impulses representing ideal load conditions are obtained from a generator and the kW or MW setting is shown on a 6in dial dynamometer wattmeter. The user can regulate the kW or MW setting and hence the rate of impulsing by a Variac control. The ideal load impulses received in each demand period are compared with impulses received from an impulsing meter or summator working from the actual load to be controlled. The difference is displayed on the discrepancy indicator.

Incorporated in the impulse comparator are one or more sets of alarm contacts, which can be made to close



Ferranti excess demand warning system panel

when a predetermined number of excess impulses of actual load over ideal load has been reached. If it is desired, a time switch can be incorporated in the alarm circuit, operating with the same interval as the tariff time switch but set five or ten minutes before. The impulse comparator and discrepancy indicator are re-set every 30 minutes—or other demand period—by the tariff switch or a time switch set coincidentally with the tariff time switch. Relays and impulsing circuits are designed for working at 50 V d.c. and a suitable rectifier unit can be supplied.

Although this equipment is intended for giving warning of excess demand, it can be adapted for load control purposes by fitting a second set of alarm contacts in the impulse comparator which close when the actual load impulses are below the ideal load impulses by a predetermined number.

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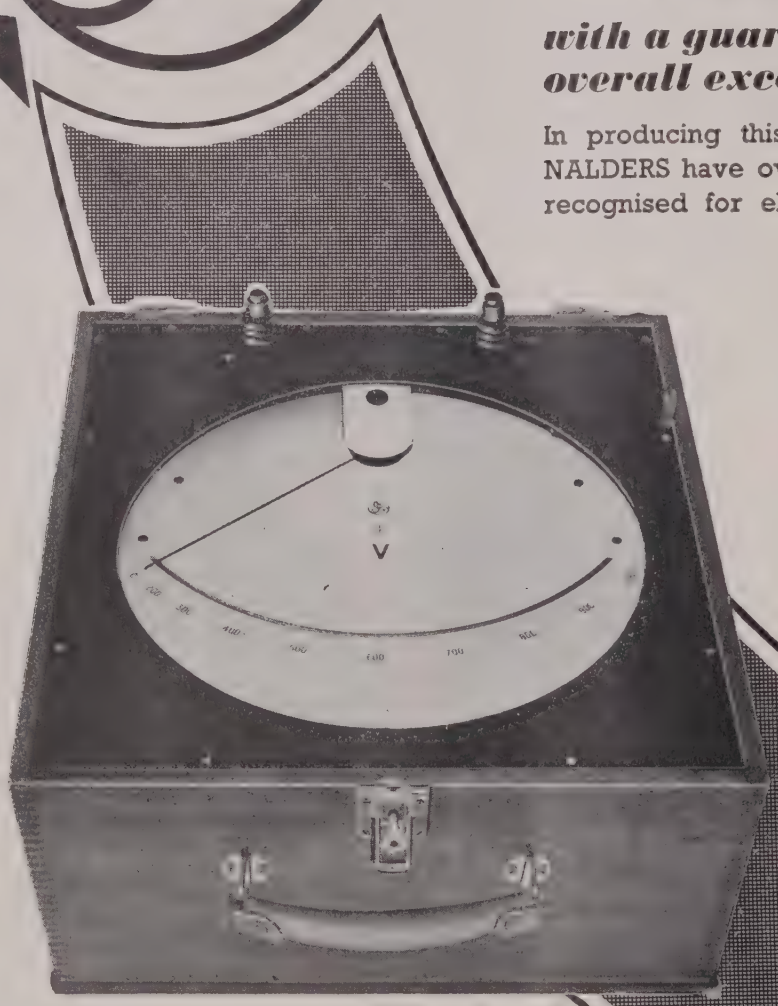
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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1955

29541. English Telephone Co., Ltd., and Hoyles, L.—Contact spring-pile-up for electrical switching devices. 17th January, 1957. (858141.)

36366. Printing, Packaging & Allied Trades Research Association.—Electronic monitoring system for colour printing. 4th January, 1957. (857701.)

1956

3686. Elliott Bros. (London), Ltd.—Dynamometer type instruments. 28th January, 1957. (857917.)

3841. Salam, H. P. A.—Polyphase oscillator and like circuits. 7th February, 1957. (858114.)

9841. J. Lucas (Industries), Ltd.—Electric plug and socket conductor couplings. 18th March, 1957. (858115.)

10318. British Thomson-Houston Co., Ltd.—Aircraft auxiliary installations. 4th April, 1957. (857782.)

11856. Black & Decker, Ltd., and Blight, N. J.—Switches for portable electric tools. 3rd July, 1957. (857941.)

11920. Electric & Musical Industries, Ltd.—Transistor switching circuits. 10th August, 1957. (858116.)

12098. Lewis, T. X.—Converting electric currents. 16th April, 1957. (858051.)

20966. English Electric Co., Ltd.—Electric resistors. 3rd July, 1957. (858117.)

22476. Wandsworth Electrical Manufacturing Co., Ltd.—Electric tumbler switches. 22nd July, 1957. (857659.)

29433. English Electric Co., Ltd.—Instrument bearings. 26th September, 1957. (857785.)

37520. Centre National de la Recherche Scientifique.—Device for increasing the luminosity of electric incandescent lamps. 7th December, 1956. (858052.)

1957

531. Eastman Kodak Co.—Apparatus for deriving electrical signals from a medium having officially dense and clear areas. 7th January, 1957. (858120.)

1162. A.E.I.-Hotpoint, Ltd.—Electrical immersion heaters. 10th January, 1958. (857909.)

2316. Steinmüller G.m.b.H., L. & C.—Simultaneous production of coal gas and electricity. 22nd January, 1957. (857919.)

5290. Thomson Products, Inc.—Alternator control systems. 15th February, 1957. (857666.)

10932. General Electric Co.—Discharge lamp envelopes. 3rd April, 1957. (Addition to 821321.) (857711.)

11163. Rauland Corporation.—Methods of preparing semiconductor devices. 5th April, 1957. (857860.)

11781. Hegstad, E.—Cable end boxes. 10th April, 1957. (857667.)

12028. Fabriek van Electrische Apparaten Voorheen F. Hazemeijer & Co. N.V.—Contact for electric high voltage circuit-breakers. 12th April, 1957. (857585.)

12029. Fabriek van Electrische Apparaten Voorheen F. Hazemeijer & Co. N.V.—Small oil volume high voltage circuit-breaker. 12th April, 1957. (857586.)

14351. United States Atomic Energy Commission.—Composite nuclear fuel element and method of manufacture. 6th May, 1957. (858061.)

17030. Rank Cintel, Ltd.—Gating circuits for electrical signals. 29th May, 1958. (857601.)

17412. General Electric Co.—Signal processing systems. 31st May, 1957. (857862.)

17749. Commissariat à l'Energie Atomique.—High temperature electrolytic cells. 4th June, 1957. (857602.)

18263. Voigtlander A.G.—Photo-electric exposure meter. 7th June, 1957. (858064.)

23602. Philips Electrical Industries, Ltd.—High-frequency inductors. 25th July, 1957. (857605.)

24732. Telefunken G.m.b.H.—Pulse frequency measuring circuit arrangements employing storage condensers. 6th August, 1957. (857863.)

29509. Jansen, B.—Tap-changing switches. 19th September, 1957. (858095.)

29806. Igranic Electric Co., Ltd., and Taylor, J. R.—Snap-action limit switch mechanisms for switches. 19th December, 1958. (857647.)

29807. Igranic Electric Co., Ltd.—Electric motor and brake control systems. 23rd September, 1957. (857911.)

31728. British Telecommunications Research, Ltd.—Equipment for the detection of frequency errors. 3rd October, 1958. (857865.)

33226/7. General Electric Co.—Electronic curve follower. 24th October, 1957. (858002/3.)

36549. British Thomson-Houston Co., Ltd.—Discharge lamp circuits. 12th November, 1958. (858004.)

1958

293. United States Atomic Energy Commission.—Method of preparing a fuel element for a nuclear reactor. 3rd January, 1958. (857672.)

1246. Siemens-Schuckertwerke A.G.—Forced-flow, once through steam boilers with at least two reheater stages. 13th January, 1958. (857714.)

2732. United-Carr Fastener Corporation.—Machine for packaging electrical contacts having a plate-like body. 27th January, 1958. (858006.)

3605. Marconi Instruments, Ltd.—Signal wave responsive and measuring circuit arrangements. 4th November, 1958. (857612.)

4609. J.F.J. Products, Ltd.—Electric plug or socket. 12th February, 1958. (858097.)

4655. Huet, A.—Nuclear reactors. 12th February, 1958. (857675.)

5583. Carr Fastener Co., Ltd.—Electric lamp housings. 17th February, 1959. (857913.)

6338. Parsons, Ltd., C. H., and Handley, G. B.—Electrical outlet plug and socket. 27th February, 1959. (858098.)

7946. General Electric Co., Ltd.—Laminated electromagnetic cores. 25th February, 1959. (857915.)

9105. Westinghouse Electric Corporation.—Temperature sensing devices for electrical apparatus. 21st March, 1958. (857614.)

9152. Western Electric Co., Inc.—Electron discharge devices and targets therefor. 21st March, 1958. (857615.)

10285/6. Associated Electrical Industries, Ltd.—Electrical connections between relatively rotating electrical conductors. 24th March, 1959. (857678/9.)

11452. Huet, A.—Nuclear reactors. 10th April, 1958. (857676.)

13869. F. C. Blackwell & Co., Ltd.—Electrical junction boxes, switch boxes and the like. 25th March, 1959. (857596.)

18498. Jack & Heintz, Inc.—Fault detector for polyphase circuits. 10th June, 1958. (857950.)

18544. Commissariat à l'Energie Atomique.—Apparatus for creating by induction an electric discharge in a gas at low pressure. 10th June, 1958. (857686.)

19390. Western Electric Co., Inc.—Parametric amplifiers. 17th June, 1958. (857652.)

19527. London Electricity Board and Mockett, H. H. J.—Apparatus for mounting an electricity meter for test purposes. 18th September, 1959. (857951.)

20559. Baird & Tatlock (London), Ltd.—Photo electronic system. 26th June, 1959. (857877.)

23863. Tesla, Narodni Podnik.—Self-supporting directly heated cathode. 24th July, 1958. (857618.)

27322. Westinghouse Electric Corporation.—Generator control and protective system. 26th August, 1958. (857687.)

29102. United States Atomic Energy Commission.—Stabilised pinch electric discharge apparatus. 11th September, 1958. (857883.)

29259. Standard Telephones & Cables, Ltd.—Clock pulse generating equipment. 12th September, 1958. (857955.)

29793. General Electric Co., Ltd.—Production of tungsten powder. 15th September, 1959. (Addition to 848462.) (857969.)

30091. General Electric Co., Ltd.—Electric switchgear. 14th August, 1959. (857957.)

31189. General Electric Co., Ltd.—Transistor oscillator circuits. 2nd September, 1959. (857775.)

31499. International Business Machines Corporation.—Sequence switch. 2nd October, 1958. (857622.)

31657. Plessey Co., Ltd.—Capacitors and method for the production thereof. 3rd October, 1958. (857885.)

33024. United States Atomic Energy Commission.—Power breeder reactor. 16th October, 1958. (857959.)

33080. British Thomson-Houston Co., Ltd.—Zirconium alloys. 24th September, 1959. (857835.)

33932. Standard Telephones & Cables, Ltd.—Magnetic trigger devices. 23rd October, 1958. (857736.)

34554. B & H Instrument Co., Inc.—Adjustable resistances. 28th October, 1958. (857597.)

37754. Siemens Edison Swan, Ltd.—Switching modulators. 17th November, 1959. (857807.)

38288. Elco Corporation.—Electrical valve sockets. 27th November, 1958. (857975.)

39842. Cheng, W. G.—Portable electric lanterns or torches. 30th June, 1959. (857051.)

40289. Standard Telephones & Cables, Ltd.—Magnetic core trigger devices. 15th December, 1958. (857506.)

41287. Westinghouse Electric Corporation.—Electron guns for cathode-ray tubes. 22nd December, 1958. (857277.)

41356. International Business Machines Corporation.—Apparatus utilising transistors for detecting a change in the sign of the slope of an electrical waveform. 22nd December, 1958. (857313.)

1959

1650. Westinghouse Electric Corporation.—Electrical pulse counting apparatus. 16th January, 1959. (856853.)

1666. Esso Research & Engineering Co.—Utilisation of nuclear energy. 16th January, 1959. (856904.)

2425. Saxony Electronics, Inc.—Hair dryer. 22nd January, 1959. (857564.)

3856. Contactor (Proprietary), Ltd.—Means for electrically heating water. 3rd February, 1959. (857365.)

5362. Thorn Electrical Industries, Ltd.—Lamp fittings. 16th February, 1959. (856531.)

6008. Soc. Nouvelle d'Electronique.—Electrical analogue to digited convertors. 20th February, 1959. (857510.)

8245. Schlelein, F.—Thermonuclear reactor. 10th March, 1959. (857137.)

8994. General Electric Co.—Method of forming luminescent screens. 16th March, 1959. (857279.)

9302. Rott, H. G. (trading as Schoeller & Co., Elektrotechnische Fabrik).—Printed circuit push-button electric selector switch. 18th March, 1959. (857171.)

11729. Philips Electrical Industries, Ltd. —Electric coils. 7th April, 1959. (857509.)

14135. Universal Winding Co.—Fuel-cell control systems. 24th April, 1959. (857368.)

14524. Bendix Corporation.—D.c. modulator. 28th April, 1959. (857280.)

15358. Standard Telephones & Cables, Ltd.—Electromagnetic latching relays. 5th May, 1959. (857638.)

18848. Lewis Appliance Corporation, Ltd.—Spin-dryer washing machines. 2nd June, 1959. (857990.)

18893. Backer Elektro-Varme A.B.—Methods of sealing tubular electric heating elements. 3rd June, 1959. (857901.)

18170. Allmänna Svenska Elektriska A.B. —Electromagnetic displacing means for neutron absorbing control rods. 28th May, 1959. (857059.)

19089. Telefunken G.m.b.H.—Method for the production of semiconductor bodies. 4th June, 1959. (857258.)

23678. Telefunken G.m.b.H.—Electromagnetic deflection arrangements. 9th July, 1959. (857325.)

26620. Outillage Electrique Silex.—Interference suppressors for electrical apparatus. 4th August, 1959. (857993.)

28177. General Electric Co.—Push-pull power amplifier. 18th August, 1959. (857643.)

28247. Polysius G.m.b.H.—Apparatus for heating fine-grained materials. 18th August, 1959. (857818.)

28501. Oster Manufacturing Co., J.—Universal salient pole electric motors. 20th August, 1959. (857994.)

28552. Maschinenfabrik Oerlikon.—Impulse voltage withstanding winding, more particularly for transformers. 20th August, 1959. (Addition to 823566.) (857329.)

29776. General Electric Co.—Electric discharge device. 1st September, 1959. (857330.)

29956. Philips Electrical Industries, Ltd. —Time-base circuits for magnetic beam deflection. 2nd September, 1959. (857998.)

32395. Philips Electrical Industries, Ltd. —Holders for replaceable liquid-cooled super high-pressure metal vapour discharge tubes. 23rd September, 1959. (857373.)

33030. Philips Electrical Industries, Ltd. —Methods of manufacturing electrodes of large surface area for electrolytic capacitors. 29th September, 1959. (857752.)

33705. Compagnie de Saint-Gobain.—Electrode in an electrically heated glass furnace. 5th October, 1959. (857375.)

34096. Standard Telephones & Cables, Ltd.—Manufacture of insulated electric cable. 8th October, 1959. (857376.)

34971. A.B. Metal Products, Ltd.—Electrical switching means. 15th October, 1959. (857845.)

35076. Scharpf, O., Scharpf, E., and Scharpf, E. (trading as Scharpf Komm.-Ges. Maschinenfabrik Geb.).—Spin dryers. 16th October, 1959. (857846.)

35089. Standard Telephones & Cables, Ltd.—Methods and apparatus for colour coding electric conductors. 16th October, 1959. (Addition to 838580.) (857847.)

35250. Fernseh G.m.b.H.—Signal amplitude limiting circuit. 19th October, 1959. (858111.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 21st January.

Plus 4. No. B798,573. Class 7. Washing and drying machines; mixing machines; and electrical machines for domestic purposes.—Gebruder Scharpf Kommanditgesellschaft Maschinen-Fabrik, Stuttgart-Zuffenhausen, Germany. Address for service: Axe Brodrick & Co., 18, Tooks Court, Chancery Lane, London, E.C.4.

Magicmaid. No. B802,766. Class 7. Electrically-driven food and drink mixing machines.—Berry's Electric, Ltd., 85/6, Newman Street, Oxford Street, London, W.1.

Peco. No. B802,986. Class 7. Electric welding machines.—Peco Elektrische Schweissmaschinenfabrik Rudolf Bocks K.G., Munich, Germany. Address for service: Barlow, Gillett & Percival, 94, Market Street, Manchester.

Starmatic. No. 807,349. Class 7. Washing machines.—Starmatic, Ltd., 128, Seymour Place, London, W.1.

Laundeluxe. No. 807,399. Class 7. Washing machines, centrifugal drying machines and parts.—Harry Morris, 186, Greengate, Salford, Lancs.

Flexodrums. No. B791,771. Class 9. Electric flexible conductors in spring-return containers and electrical connections therefor.—Flexdrums, Ltd., 23, Uphall Road, Ilford, Essex.

Lamson. No. 793,468. Class 9. Electric vacuum cleaners for use in industry.—Lamson Engineering Co., Ltd., 6/8, Hythe Road, Willesden Junction, London, N.W.10.

Burnerd.—No. 794,026. Class 9. Apparatus and instruments for measuring, indicating, weighing, signalling, testing or checking; electrical apparatus for use in demagnetising of metallic objects; welding apparatus and electrodes; electrical and electronic apparatus and installations for use in the automatic control of industrial operations, etc.—F. Burnerd & Co., Ltd., 5, Balfour Place, Park Lane, London, W.1.

Design (cathode-ray tubes). No. B797,504. Class 9. Cathode-ray tubes, parts and fittings.—Enfield Electronics (CRT), Ltd., 5, Station Close, Potters Bar, Middlesex.

Design and **Stemag.** Nos. B805,088 and B805,091. Parts included in Class 9 of electrical and electronic apparatus and instruments; magnets; and condensers, resistances, potentiometers, switches and choking coils. Nos. B805,089 and B805,092. Class 11. Installations and apparatus for heating and lighting. Nos. B805,090 and 805,093. Class 17. Insulators and insulating material. **Kerafar.** No. 805,428. Class 11. Installations and apparatus for heating and lighting but not including kilns.—Steatit-Magnesia Akt.-Ges., Lauf (Pegnitz), Germany. Address for service: Gill, Jennings & Every, 51/52, Chancery Lane, London, W.C.2.

Venner (design). No. 806,983. Class 9. Electric time switches, indicating gauges, hour recording meters, electricity meters, animal fences with electric charging means, electrical apparatus for automatically controlling the lighting up of pedestrian crossings, and time delay action contrivances for controlling the operation of electrical and mechanical apparatus.—Venner, Ltd., Kingston By-Pass, New Malden, Surrey.

Dataflex. No. 806,950. Class 9. Scientific, electrical and electronic apparatus and instruments.—Ericsson Telephones, Ltd., Telephone Works, Beeston, Notts.

Pentika. No. 808,463. Electronic apparatus included in Class 9; and apparatus for recording sound, etc.—VEB Kamera-und Kinowerke Dresden, Germany. Address for service: Matthews, Haddan & Co., 31/32, Bedford Street, Strand, London, W.C.2.

Digivisor. No. 808,619. Class 9. Electrical measuring apparatus and instruments, parts and fittings.—Electrical Apparatus Co., Ltd., New Barnes Avenue, St. Albans, Herts.

Morlec. No. 808,801. Electrical apparatus and instruments included in Class 9.—Morse's, Ltd., 10/12, Regent Street, Swindon, Wilts.

Banda-Tronic. No. 810,956. Class 9. Computing machines and parts.—Block & Anderson, Ltd., 58/60, Kensington Church Street, London, W.8.

Practix. No. 804,568. Class 10. Electromedical and X-ray apparatus and appliances. —Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Ever Ready. No. 806,144. Class 10. Electric blankets. No. 806,145. Class 11. Domestic electrical appliances.—Ever Ready Co. (Gt. Britain), Ltd., Hercules Place, Holloway, London, N.7.

DisChil (design). No. 798,132. Class 11. Freezing and refrigerating apparatus.—Distillers Co., Ltd., Devonshire House, Mayfair Place, Piccadilly, London, W.1.

Magicold. No. B802,660. Class 11. Refrigerators and parts.—Berry's Electric, Ltd., 85/86, Newman Street, Oxford Street, London, W.1.

Homelight. No. 804,182. Class 11. Refrigerators, refrigerating plant and installations.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

Street Lighting Plans

Middlesbrough Town Council is being recommended to include £65,600 in next year's estimates for the provision of electric lighting in place of gas along 41 bus routes and principal streets in the town. A further £11,670 will be spent on installing lighting on new housing estates.

Whitby U.D.C. is contemplating spending £10,000 on improvements to electric street lighting.

Redcar Town Council is including a further £10,000 for electric street lighting in its annual estimates.

Burnley Street Lighting Sub-Committee proposes to spend £17,700 on the third phase of the street lighting conversion programme.

Bishop Auckland (Co. Durham) U.D.C. has approved a revised scheme for installing sodium vapour lighting from Cabin Gate to Canney Hill. The cost will be nearly £4,000.

Whitley Bay Town Council is being recommended to include a further £19,200 in its estimates for converting street lighting from gas to electricity.

The seventh stage of **Colchester** Town Council's street lighting improvement scheme is estimated to cost £7,300.

Scarborough Town Council is including £105,000 in its next estimates to cover the cost of further work on the conversion of street lighting from gas to electricity. Sanction has been received to borrow £4,722 for the provision of fluorescent street lighting in part of Scalby Road.

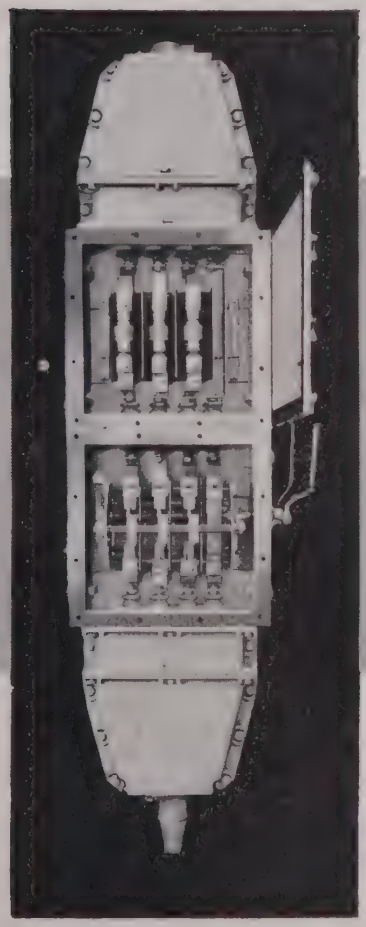
Walsall Public Works Committee recommends the erection of electric lamps in residential roads at an estimated cost of £21,870.

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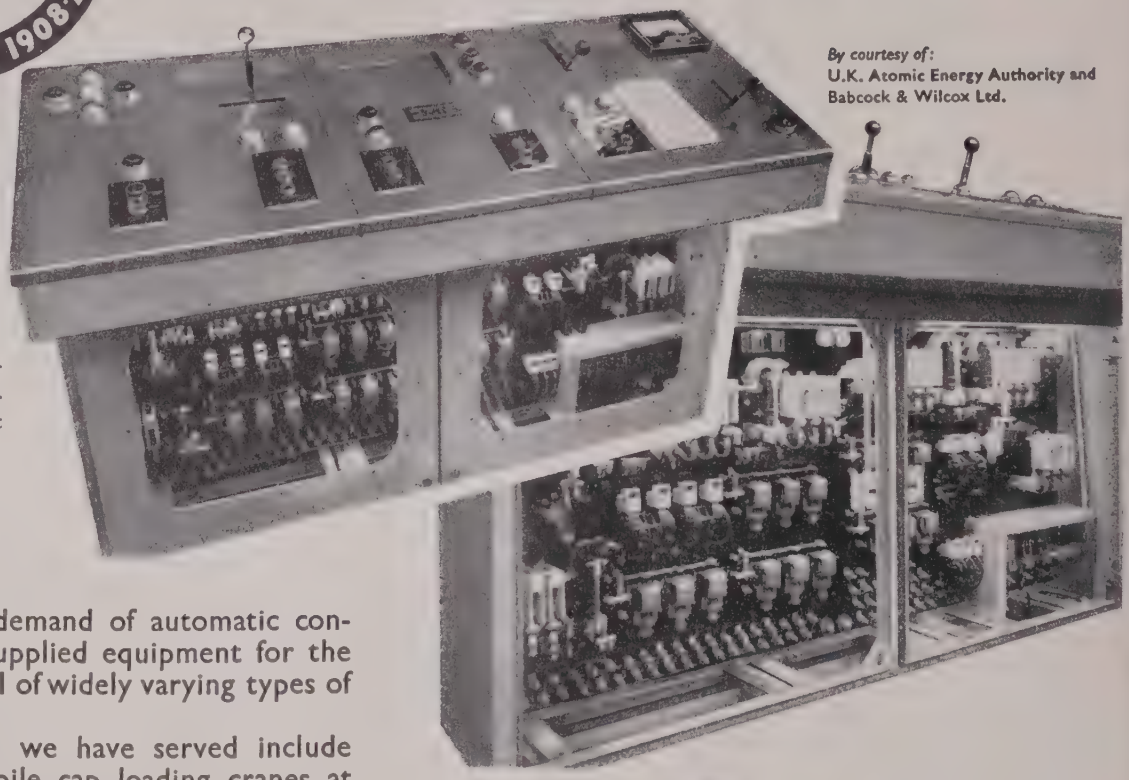
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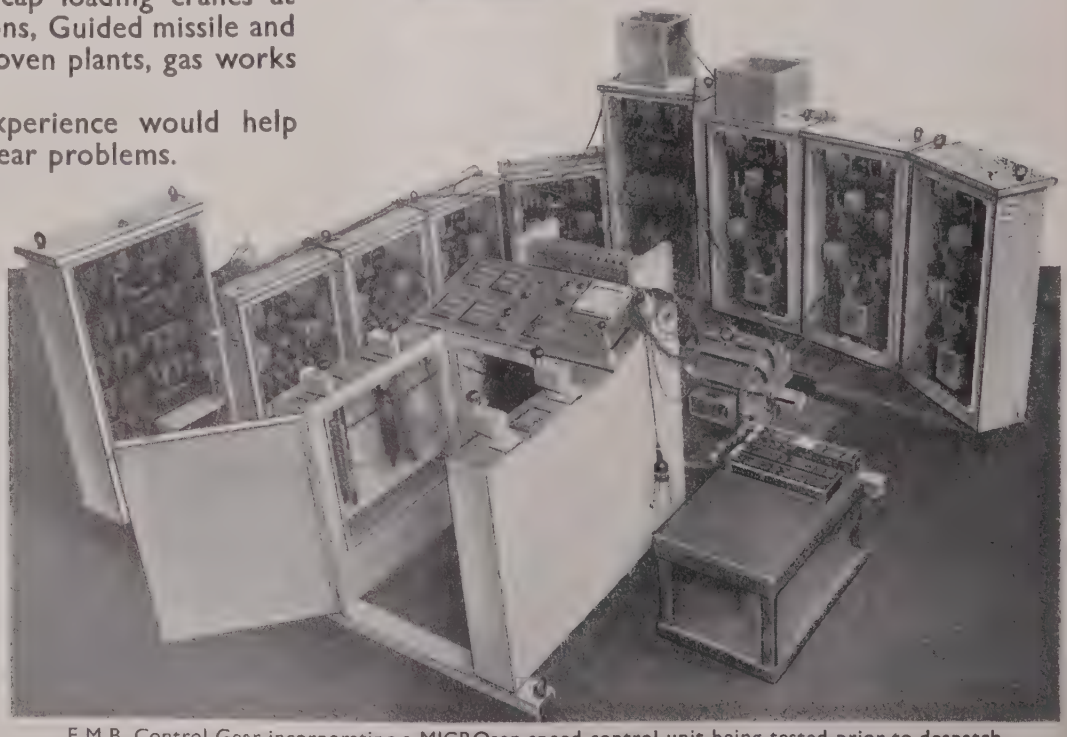
Control Gear



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Control desk for the Babcock Mechanical Handling plant at Chapelcross.

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E.M.B. Control Gear incorporating a MICROsen speed control unit being tested prior to despatch to Berkeley Atomic Power Station for pile cap handling equipment.

E.M.B. Co. Ltd.

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 9th JANUARY

Birmingham.—College of Technology, Gosta Green, 6 p.m. I.E.E. South Midland Supply and Utilisation Group. "The Application of Irradiation in Industry," by M. C. Crowley-Milling.

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. Colour film of the 1959 Electrical Engineers (A.S.E.E.) Exhibition; and film "Prelude to Power."

Bournemouth.—Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth and District Branch. "Heat Pumps," by Miss M. V. Griffith.

Cardiff.—South Wales Institute of Engineers, 6 p.m. I.E.E. Western Centre. "Brushless Variable-Speed Induction Motors," by E. R. Laithwaite.

Edinburgh.—South of Scotland Electricity Board, Dewar Place, 7.30 p.m. I.E.E. South East Scotland Graduate and Student Section. Film evening.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "Recent Research in Thermionics," by G. H. Metson.

Federation of British Industries, Tothill Street, S.W.1, 6 p.m. Illuminating Engineering Society. "Modern Aids to Lighting Design—Computer Techniques," by H. R. Ruff, H. E. Bellchambers and G. K. Lambert.

Falk, Stadelmann, Ltd., Mount Street, W.1, 7.15 p.m. A.S.E.E. Central London Branch. Discussion and visit.

Newcastle-upon-Tyne. — Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre. Third Hunter Memorial Lecture: "The Application of Electronics to the Electricity Supply Industry," by Dr. J. S. Forrest.

County Hotel, Neville Street, 6.30 p.m. North East Electrical Club. "Unusual Applications of Refrigeration," by S. B. Warburton.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.S. Sheffield Centre. "Recent Developments on the Continent in Exterior Lighting," by A. G. Penny.

Royal Victoria Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Safety in the Electrical Industry," by G. W. Walliss.

Stafford.—Technical College, 7.15 p.m. North Staffs. Graduate and Student Section. "Colour Television," by P. S. Carnt.

Wembley.—Century Hotel, 8.15 p.m. A.S.E.E. North West London Branch. "Road Lighting," by S. J. Cooper.

TUESDAY, 10th JANUARY

Basingstoke. — Station Hotel, 8 p.m. A.S.E.E. Aldershot and Districts Branch. "The National Inspection Council," by T. Howell.

Belfast.—Civil Engineering Department, David Keir Building, Queen's University, Stranmillis Road, 6.30 p.m. I.E.E. Northern Ireland Centre. "Discrimination between H.R.C. Fuses," by E. Jacks.

Broadstairs.—Clarendon Hotel, 8 p.m. A.S.E.E. East Kent Branch. "Transformers and their Basic Design Principles," by J. F. Yates.

Cardiff.—Park Hotel, Park Place, 7.30 p.m. A.S.E.E. South Wales Branch. Films evening.

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. Second Hunter Memorial Lecture. "The Protection of Electrical Systems," by H. G. Bell.

Glasgow.—Kenilworth Hotel, Queen Street, 8 p.m. A.S.E.E. Glasgow Branch. Film evening.

Leeds.—Leeds and County Conservative Club, South Parade, 7 p.m. I.E.E. North Midland Graduate and Student Section. Centre chairman's address by F. W. Fletcher.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. Lecture "Precision Measurement," by G. H. Rayner and A. Felton, supported by the following papers:—"Improvements in the Precision Measurement of Capacitance," by G. H. Rayner and L. H. Ford; "Design of an Audio-Frequency Amplifier for High-Precision Voltage Measurement," by S. Harkness and F. J. Wilkins; "The Design and Performance of High-Precision Audio-Frequency Current Transformers," by J. J. Hill and A. P. Miller; and "Techniques for the Calibration of Standard Current Transformers up to 20 kc/s," by J. J. Hill.

Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2, 7 p.m. Institution of Plant Engineers. "Recent Developments in Lighting," by H. Hewitt.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Luncheon.

Luton.—Luton College of Technology, Park Square, 7.30 p.m. Institution of Production Engineers, South Eastern Region. "Operational Research Techniques in Production Engineering," by J. Murdoch.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Centre. "Radio Communication in the Power Industry," by E. H. Cox and R. E. Martin.

Portsmouth.—Committee Rooms, Ministry of Labour Offices, Lake Road, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. "Trunk Dialling System."

Rugby.—College of Engineering Technology, 6.30 p.m. I.E.E. Rugby Graduate and Student Section. "Production of Semiconductor Power Rectifiers," by P. J. Pugh.

Sheffield.—Grand Hotel, 2.30 p.m. Combustion Engineering Association, Northern Region. Discussion on "The Problem of Grit Emission," to be opened by J. W. Batey.

TUESDAY, 10th JANUARY to THURSDAY, 12th JANUARY

Bristol.—The University. Institute of Physics and the Physical Society. Conference on "Physics of Polymers."

WEDNESDAY, 11th JANUARY

Birmingham.—Birmingham Exchange and Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Control Centres for Modern Industry," by A. S. Paice.

James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. "Colour Television," by P. S. Carnt.

Cardiff.—Welsh College of Advanced Technology, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. "The Measurement of Ionising Radiation," by R. G. Wood.

Edinburgh.—Y.M.C.A. Social Room, 14, South St. Andrew Street, 6.15 p.m. I.E.S. Edinburgh Centre. Paper by Centre chairman.

Liverpool. — Liverpool International Library, William Brown Street, 7.30 p.m. Institution of Production Engineers, North Western Region. "Recent Developments in the Soviet Union," by Dr. D. F. Galloway.

London.—1, Birdcage Walk, Westminster, S.W.1 Institution of Mechanical Engineers, London Branch. "The Design, Commissioning and Operation of Blyth "A" Power Station," by A. E. Powell and E. Forth.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 7.15 p.m. British Institution of Radio Engineers. "Multi-layer Switching Devices," by G. F. Taylor, preceded at 6 p.m. by annual general meeting.

Luton.—Luton College of Technology, Park Square, 8.15 p.m. A.S.E.E. Luton Branch. "The Development of Motor Control Centres," by F. Caesar-Gordon.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Electronics and Communications Group. "The Ultrasonic Microscope," by C. N. Smyth.

Newcastle-upon-Tyne.—Room B7, The Percy Building, King's College, Queen Victoria Road, 6.15 p.m. I.E.S. Newcastle-upon-Tyne Centre. Films on lighting.

Newport.—King's Head Hotel, 6.30 p.m. Newport and District Electric Club. "Electricity in the Coal Industry," by D. Evans.

Northampton.—Room B16, College of Technology, 7.15 p.m. Northampton and District Electrical Association. "Radio and TV Aerial Development," by B. Sykes.

Preston. — N.W.E.B. Demonstration Theatre, Friargate, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "Some Considerations in the Application of Power Rectifiers and Convertors," by J. P. McBreen.

THURSDAY, 12th JANUARY

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford and District Branch "Modern Light Sources."

Bristol.—Assize Court Hotel, 12.30 p.m. Engineers' Guild, Western Branch. Luncheon meeting.

Dundee.—Electrical Engineering Department, Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "Discrimination between H.R.C. Fuses," by E. Jacks.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilisation Section. "A New Form of Crane-Hoist Control using a 3:1 Pole-Changing Induction Motor," by O. I. Butler and V. Ahmad.

Manchester.—North Western Electricity Board Demonstration Theatre, Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Chemical Reaction of Light on Colour Film," by R. B. Collins.

Newcastle-upon-Tyne.—Roadway House, Oxford Street, 7 p.m. Institution of Plant Engineers. "Fire Prevention in Factories."

Reading.—Great Western Hotel, 6 p.m. Engineers' Guild, Western Home Counties Branch. Inaugural meeting.

Swansea.—Conference Room, South Wales Electricity Board, Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Characteristics and Protection of Semiconductor Rectifiers," by D. B. Corbyn and N. L. Potter.

FRIDAY, 13th JANUARY

Aberdeen. — Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Discrimination between H.R.C. Fuses," by E. Jacks.

Birmingham.—Queen's Hotel, 7 for 7.30 p.m. I.E.S. Birmingham Centre. Annual dinner.

London.—Café Royal, 7 for 7.30 p.m. I.E.E. Utilisation Section. Dinner-dance.

Caxton Hall, Westminster, 6.30 p.m. Electrical Power Engineers' Association. "Cast Resin Engineering," by H. S. Lewis.

Imperial College of Science and Technology, Exhibition Road, S.W.7, 4.30 p.m. University Lecture. "Education and Research into Instrumentation in the Technological University of Delft," by Prof. C. J. D. M. Verhagen. Admission free, without ticket.

Newcastle-upon-Tyne.—Grey Hall, King's College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. "Peltier Effects in Semiconductors," by D. E. Clark.

SATURDAY, 14th JANUARY

Bristol.—Grand Hotel. A.S.E.E. Bristol and West of England Branch. Annual dinner

London.—Clarendon Restaurant, Hammersmith Broadway. A.S.E.E. West London Branch. Annual dinner and dance.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Victorian Railways, Melbourne. 1st February. Ten diesel-electric locomotives. (E.S.B. 33690/60.)*

P.M.G.'s Department, Melbourne. 26th January. Testing instruments. (E.S.B. 33375/60.)* 28th February. Television transmitting equipment. (E.S.B. 33376/60.)*

Electricity Trust of South Australia, Adelaide. 2nd February. 33 kV switchgear. (E.S.B. 33396/60.)*

State Electricity Commission of Victoria, Melbourne. 15th March. 230 kV switchyard. (E.S.B. 32481/60.)*

State Electricity Commission of Western Australia, Perth. 29th June. Two 550 klb/hr pulverised-fuel-fired boilers with housing for the 60 MW turbo-alternators and steam generating units. (E.S.B. 33383/60.)*

Belfast.—Corporation Electricity Department. 3rd February. Air heater element cleaning equipment at the West power station. (See this issue.)

British West Indies. — Trinidad and Tobago Electricity Commission. Extension of "B" power station. Applications for registration forms should be made to Howard Humphrey & Sons, Standard Life Building, 1, Edward Street, London, S.W.1, before 21st January. (E.S.B. 33400/60.)*

8th February. P.v.c.-insulated aluminium conductors. (E.S.B. 33614-5/60.)* Insulating oil. (E.S.B. 33619/60.)* Steel stay wire. (E.S.B. 33609-10/60.)* Crosby clips (E.S.B. 33622-4/60.)* Duplex and triplex l.v. overhead service conductors. (E.S.B. 33611-3/60.)* Insulators. (E.S.B. 33616/60.)* 12 kV underground cables and accessories. (E.S.B. 33625/60.)* Earth rods. (E.S.B. 33628/60.)* Submarine cables. (E.S.B. 33627/60.)* Distribution transformers. (E.S.B. 33626/60.)*

Carmarthen.—Corporation. 23rd January. Street lighting improvements. (See this issue.)

Durham.—County Council. Electric water heating installation at Catchgate County and Modern Schools, renewal of electrical installation at Wheatley Hill Modern School, and installation of electric wiring at West Pelton New Modern School. G. W. Gelson, county architect, South Street, Durham.

Ealing.—Borough Council. 26th January. Renewal of electrical installation at Stanhope Primary School, Greenford. (See this issue.)

Essex.—County Council. Renewal of electrical installation in Grays Thameside County Junior and Infants' Schools. Contractors wishing to tender for this work should apply by 14th January. (See this issue.)

Greece.—N.A.T.O. Infrastructure Contract. 24th February. Supply and installation of electrical equipment and construction of eight substations. Applications to tender by 14th January. (G.D. 153/60(21).)† 20th March. Electrical distribution networks at three airfields. (G.D. 1316/60(20).)†

India. — Rihand Hydro-Electric Design Directorate, Kanpur. 17th January. Substation lighting equipment. (E.S.B. 33338/60.)*

Deputy Controller of Stores, Calcutta. 14th February. Portable welding plant. (E.S.B. 32840/60.)*

Director-General of Supplies and Disposals, New Delhi. 17th January. Overhead electric travelling cranes. (E.S.B. 33601/60.)* 24th January. Nine travelling cranes. (E.S.B. 33337/60.)* 1st February. Four travelling cranes. (E.S.B. 33602/60.)*

U.P. State Electricity Board. 15th March. Switchgear and protective equipment for Matatila power station. (E.S.B. 33860/60.)*

Jordan.—Jordan Cement Factories Co. 28th January. Electrical equipment for cement factory extension. (E.S.B. 33801/60.)*

Kuwait.—Department of Electricity, Water and Gas. 1st February. 11 kV overhead line equipment. (E.S.B. 33819/60.)*

Newcastle-on-Tyne.—City Council. Electrical installation and electric passenger lift in old people's home, Montagu estate. City architect, 18, Cloth Market.

New Zealand.—G.P.O., Wellington. 25th January. Marine radar equipment. (E.S.B. 33392/60.)* 2nd February. Radio test instruments. (E.S.B. 33390/60.)*

Pakistan.—Eastern Bengal Railway, Paharali, Chittagong. 16th-17th January. Five 20 kW diesel-engine-driven generating sets. (E.S.B. 33362 and 33399/60.)* 17th-18th January. Eleven 10 kW diesel sets. (E.S.B. 33357-9, 33365 and 33367/60.)* 19th January. Two motor-driven refrigeration compressors. (E.S.B. 33363/60.)* 21st January. Automatic door switches. (E.S.B. 33361/60.)* Motor-generator set. (E.S.B. 33366/60.)* Transformer, h.v. switchgear and l.v. switchboard. (E.S.B. 33360/60.)*

Posts and Telegraphs Directorate General. 24th January. Teleprinter switchboards. (E.S.B. 33820/60.)* 25th January. Power equipment for 300-line exchange. (E.S.B. 33821/60.)* 6th February. V.h.f. radio network. (E.S.B. 33824/60/D.L.F.)*

Portugal.—N.A.T.O. Infrastructure Contract. 20th January. Electrical and electronic equipment for four Loran stations. (G.D. 5769/58(17.)†

Scotland.—N.A.T.O. Common Infrastructure Slice VI: Naval Base Installations. 28th June. Electrical installation work in depot in Dunbartonshire area. (See this issue.)

South Vietnam. — Central Purchasing Authority, Saigon. 18th January. Valves for transmitters and receivers. (E.S.B. 33605/60.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Accrington.—Shopping centre, Broadway; Arndale Property Trust, Ltd., Howard House, Bank Street, Bradford.

Berwick.—Proposed maltings at Tweedmouth for J. P. Simpson & Co.; Norman Dent, architect, Finkle Street Chambers, Richmond (Yorks).

Boldon (Co. Durham).—Junior school, Cleadon; county architect, South Street, Durham.

Bristol.—Showrooms and offices, 49, Prince Street; E. & L. Rowe Investments, Ltd., 18, The Hermitage, London, S.E.13.

Bromborough.—Works and offices; James Austin, Ltd., Kirkby, near Liverpool.

Buckhurst Hill. — Extensions to High School for Boys; Bird & Watts, architects, Clays Lane, Loughton.

Buckley.—Housing estate, Western Park; Ronald S. Biggins & Associates, architects, Richmond House, Boughton, Chester.

Castle Ward (Northumberland).—Printing works at Ponteland for C. A. MacDonald, Ltd.; Stephenson, Gillis & Partners, architects, Saville Chambers, Newcastle-on-Tyne.

Chesterfield.—Factory, Whittington Moor; Alloy Steel & Iron Co., Ltd., Solidus Works, Whittington Moor, Chesterfield.

Durham.—Housing developments in the Crossgate area; Tarren & Caller, architects, 16, Great North Road, Newcastle-on-Tyne.

Extensions to Bede College (£30,000); Cordingley & McIntyre, architects, Owengate, Durham.

Exeter.—Factory extension; Herbert J. Gray, Ltd., 16, Bridge Street.

Gateshead.—Redevelopment of land at 68-76, High Street for Isaac Tucker & Co., Ltd., brewers; Arthur & Kirkup, architects, 13, Swinburne Street, Gateshead.

Shops, 265-9, High Street; Moores Group Organisation, Ltd., Fernwood Road, Jesmond, Newcastle-on-Tyne.

Grimsby.—Training centre for the mentally handicapped (£23,500); borough engineer.

Hexham. — Supermarket, Fore Street; Hadrian Supply Co., Ltd., Norham Road, North Shields.

Jarrow.—Houses (109), Lord Street area; borough engineer.

King's Lynn.—Dwellings (72), Mill Lane; Jacques & Greeves, Ltd., 3, Cedar Road, Balby, Doncaster.

Lincoln.—Civic Centre; city architect.

London. — Flats, Broadhurst Gardens, Hampstead; Herbert Kennard, Ltd., 9, Streatham High Road, S.W.16.

Ten-storey offices, Warwick Row, Westminster; City of London Real Property Co., Ltd., 16, Mark Lane, E.C.3.

Luton. — Central library (£250,000); borough architect.

Newcastle-on-Tyne. — Sports pavilion, Bullocksteads (£45,000); city architect, 18, Cloth Market.

Northumberland.—Junior school, Shiremoor (£58,000); county architect, 30, Great North Road, Newcastle-on-Tyne.

Redcar.—Aged people's bungalows (270); borough engineer.

Shildon (Co. Durham).—Houses (21), Jubilee Fields estate; U.D.C. surveyor.

South Shields.—Ten shops and flats, Mile End Road (£42,500); borough engineer.

Spalding.—Supermarket; Central & Provincial Properties, Ltd., New Bridge Street, London, E.C.4.

Stalybridge.—Flats and maisonnettes (40), Castle Hill; borough surveyor.

Sunderland.—Comprehensive school, Hylton Red House estate (£580,000); borough architect, Grange House, Stockton Road.

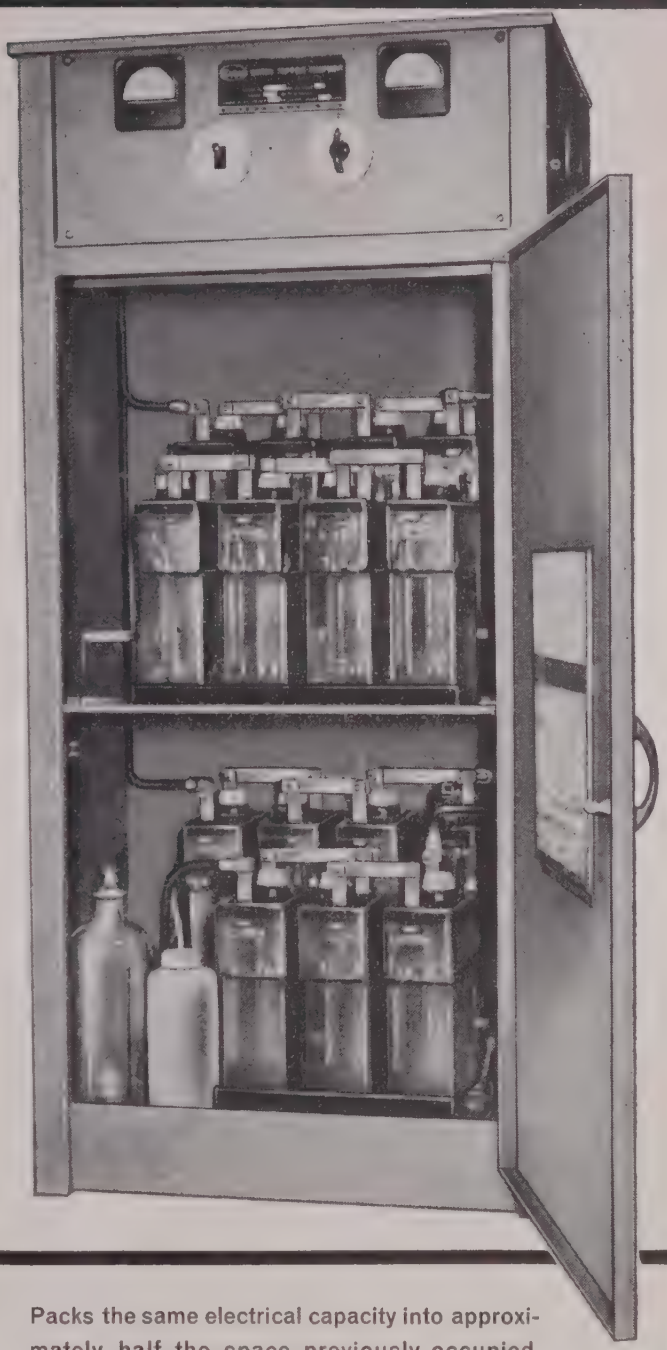
Swansea.—Mining and engineering block for College of Technology; borough architect.

West Hartlepool.—R.C. modern school, Catcote Road; T. Crawford, architect, 80, Borough Road, Middlesbrough.

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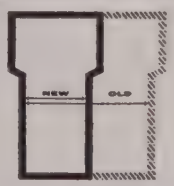
* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given. †Telephone: Trafalgar 8855, Ext. 2010.

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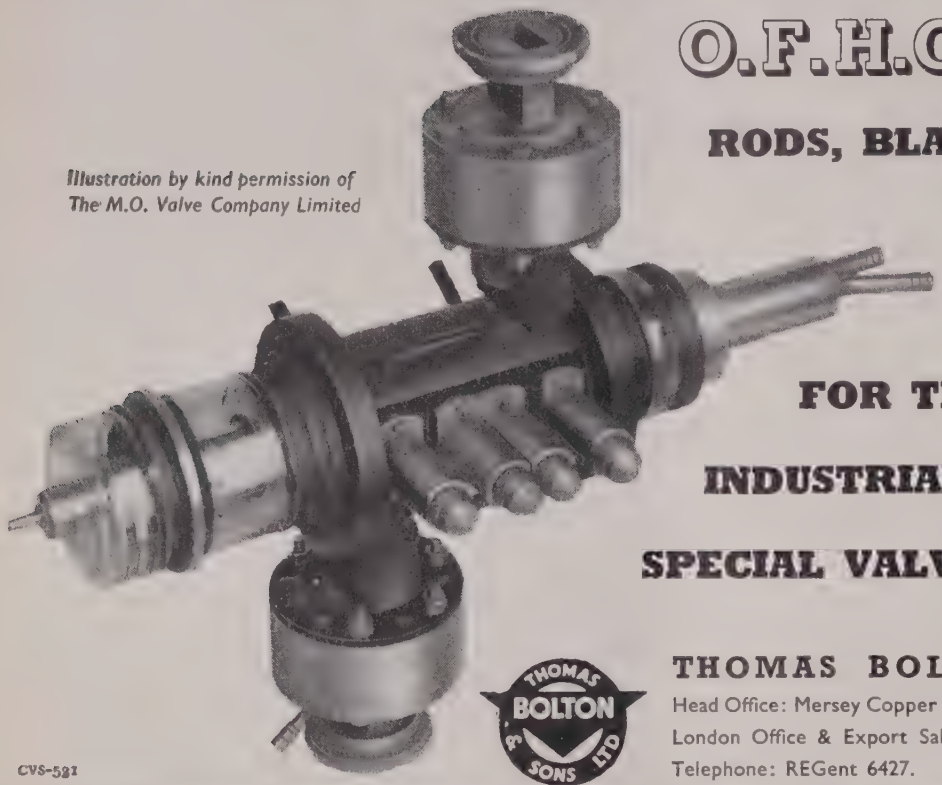


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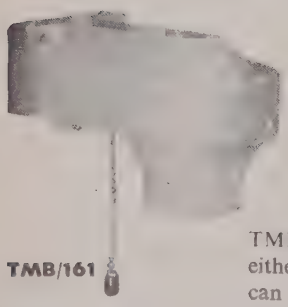
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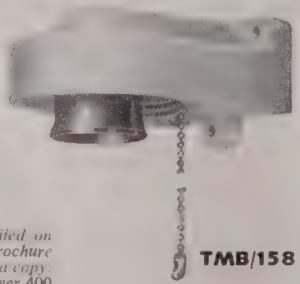
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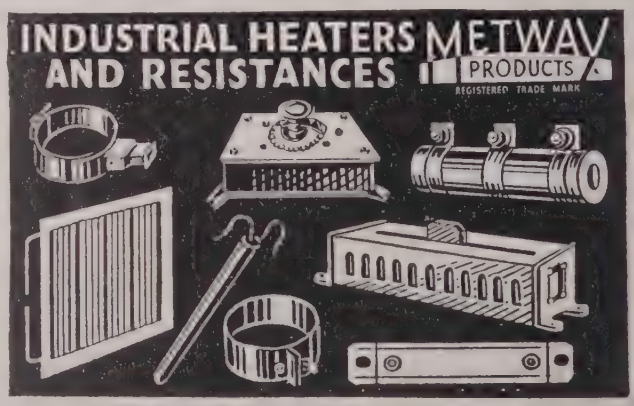
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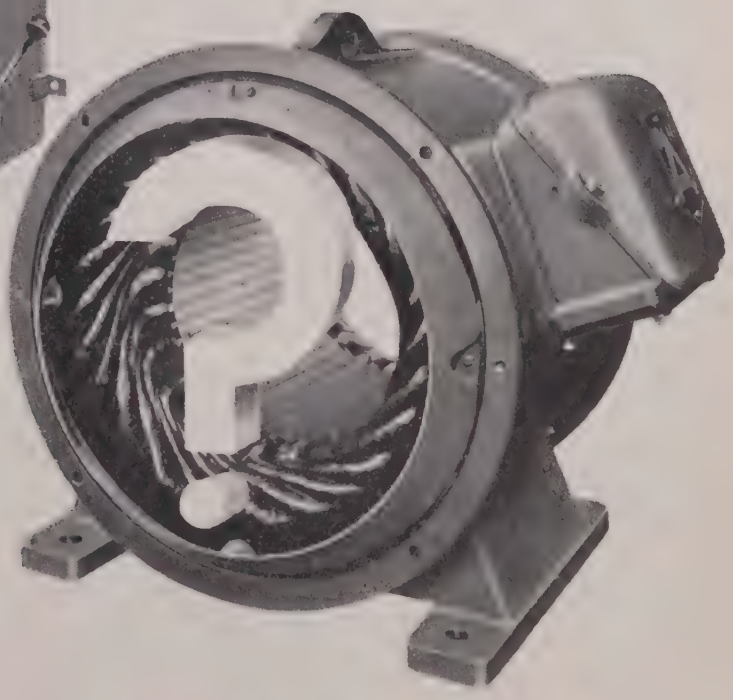
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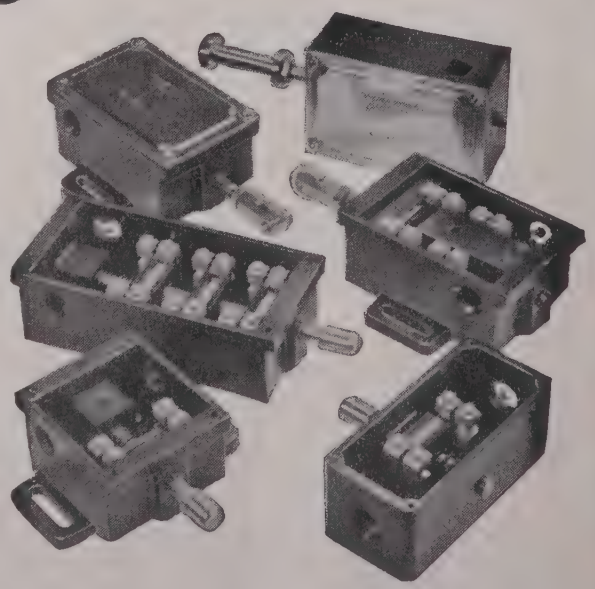
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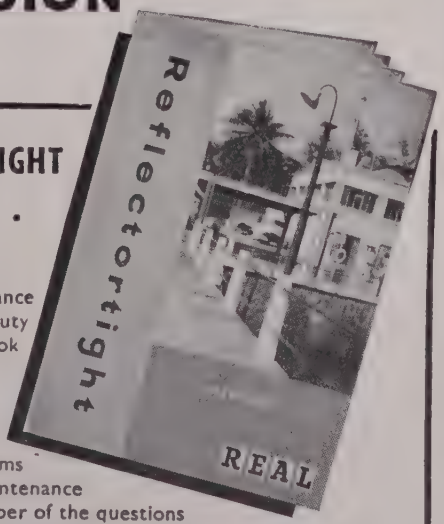


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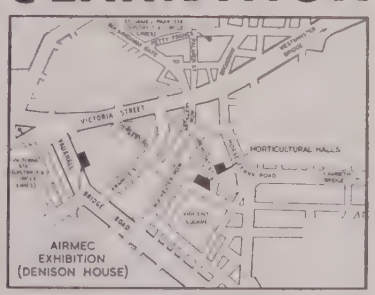
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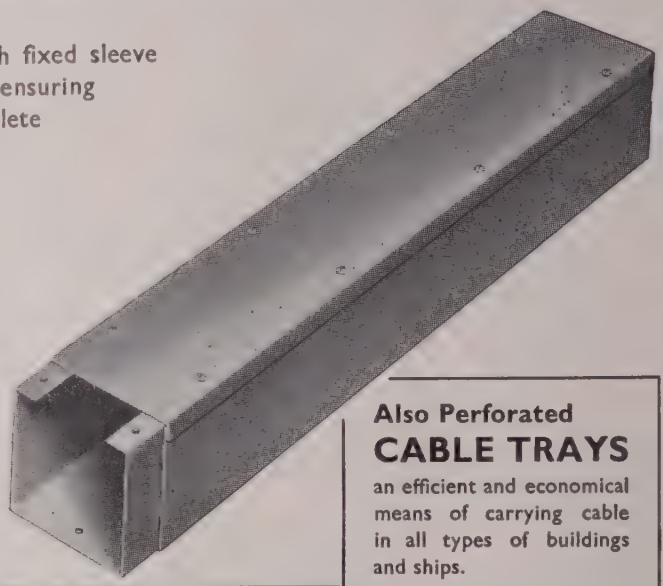
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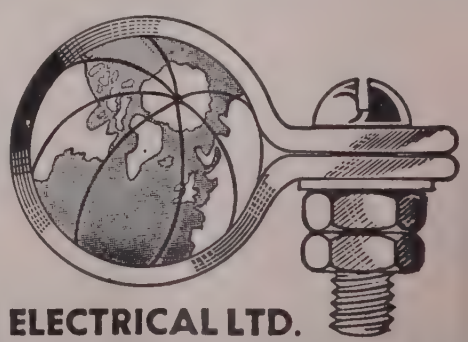
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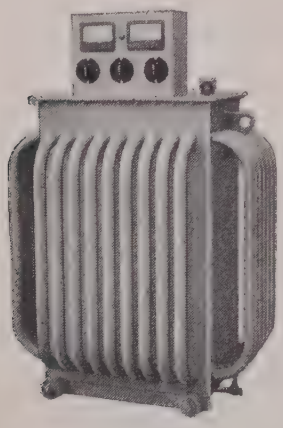
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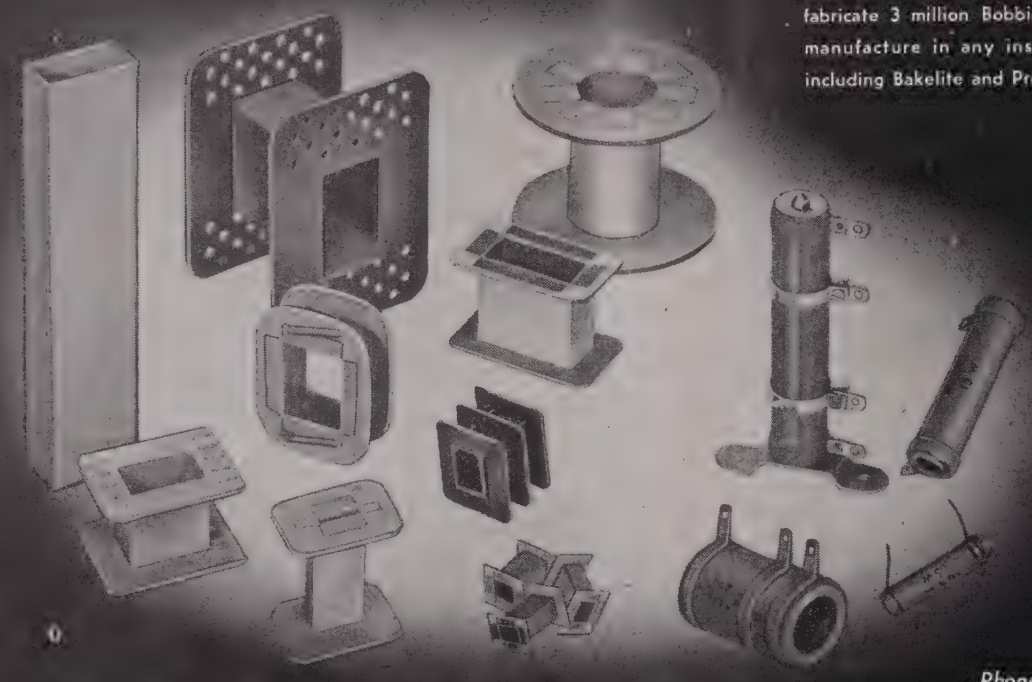


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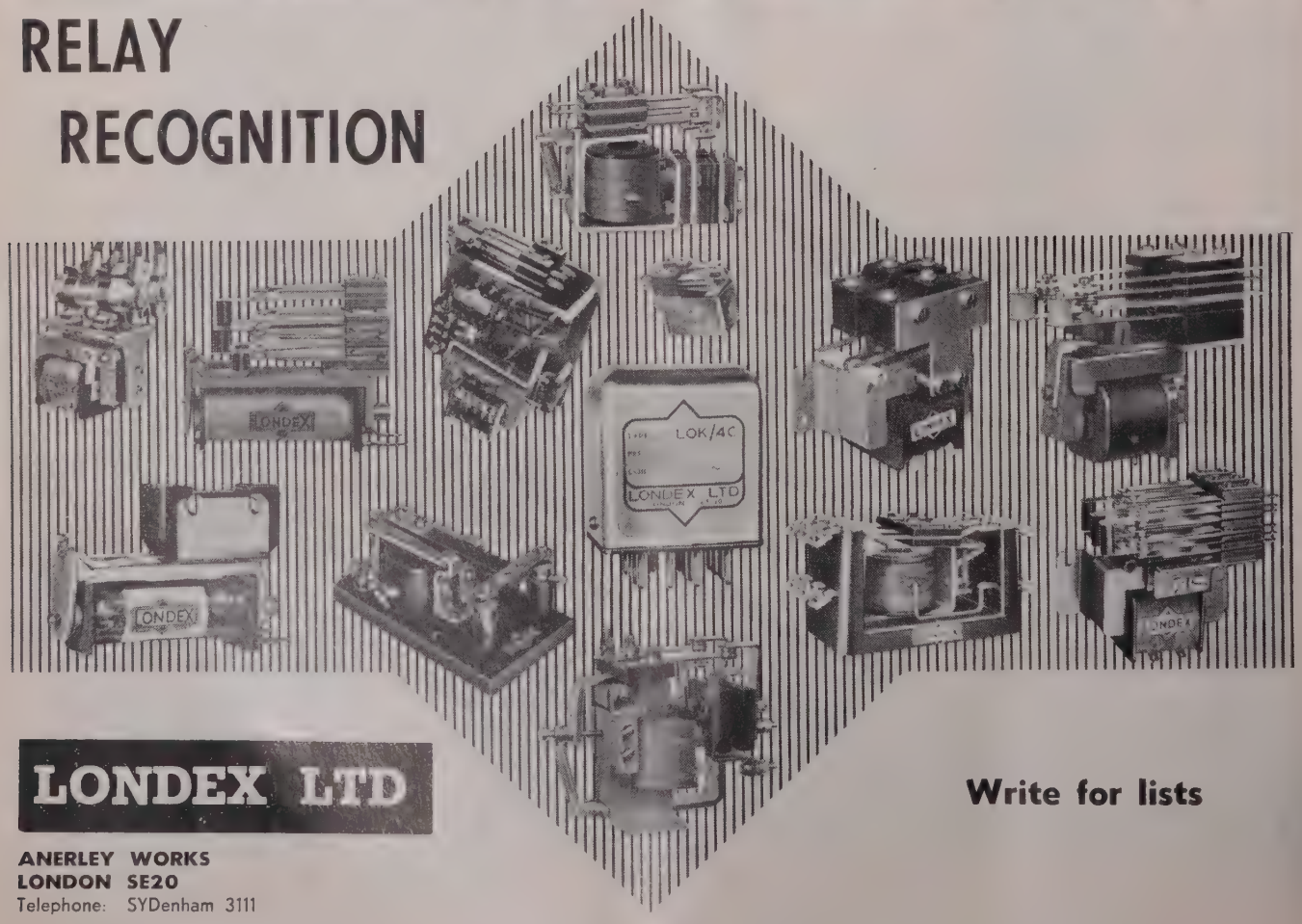
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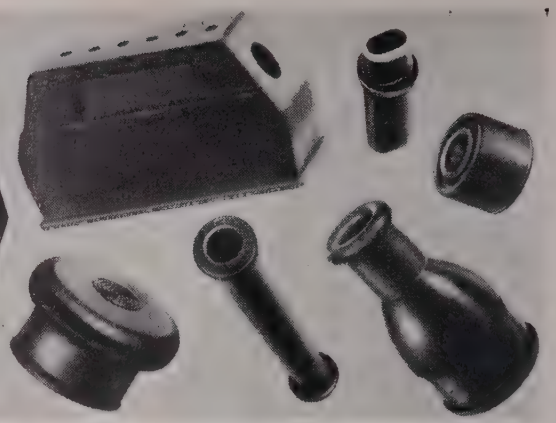
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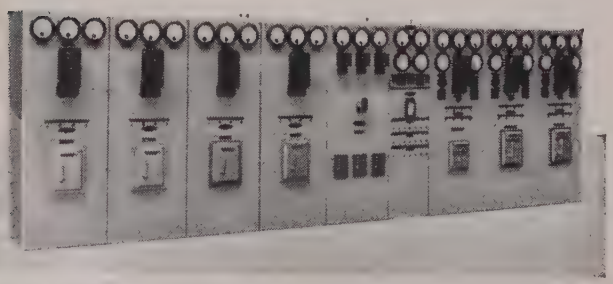


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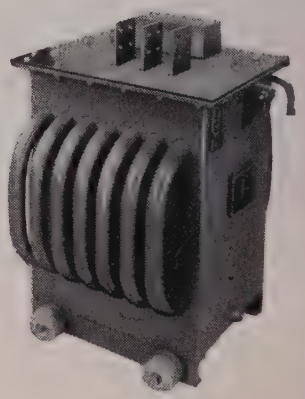


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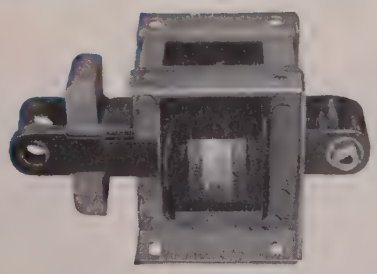
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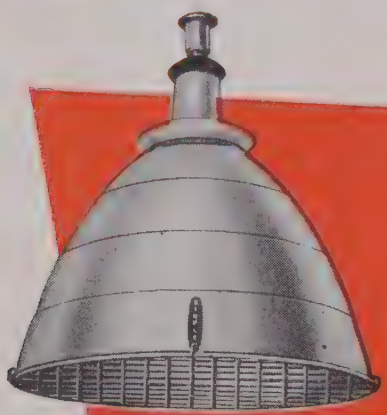
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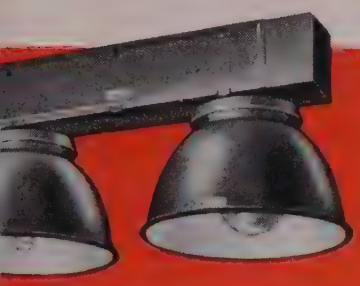
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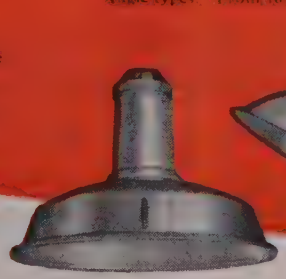
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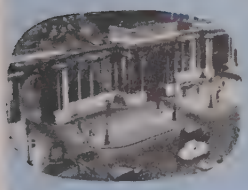




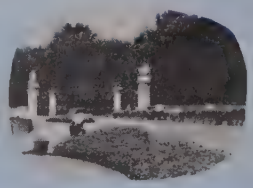
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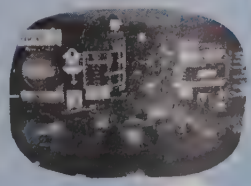
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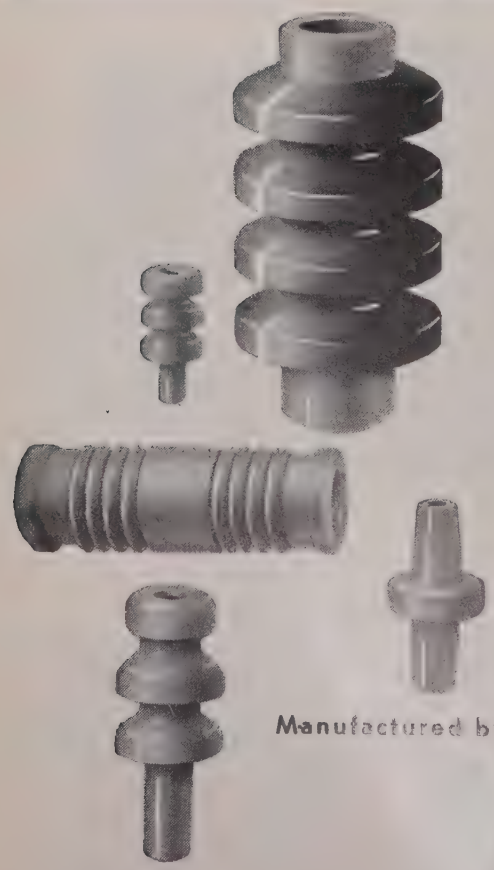
Illustration shows engineers assembling bogies fitted with Hoffmann equipment for the all-silver high capacity passenger coaches built by Metropolitan Cammell Carriage and Wagon Company Ltd., for the Piccadilly Line.

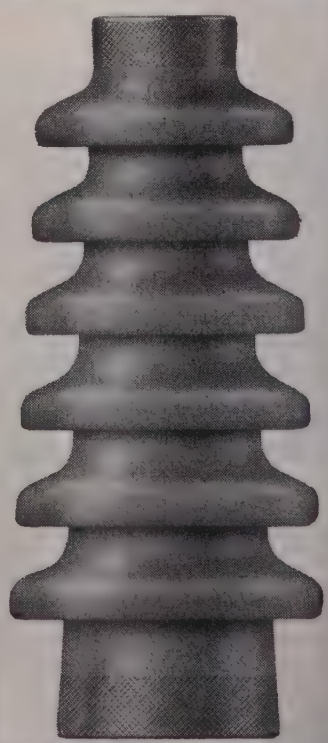
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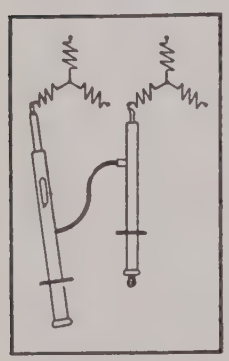
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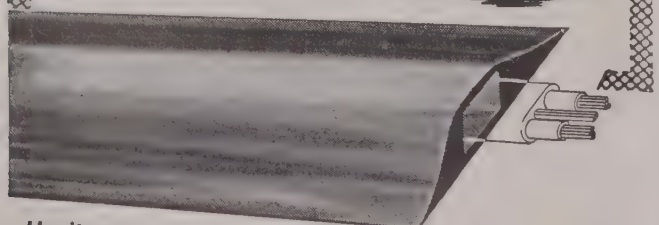
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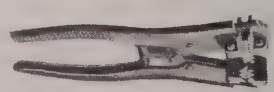
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STRIPPING

AND INCREASE PRODUCTION

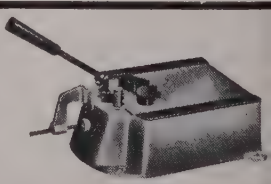


E-Z WIRE STRIPPER

One squeeze of the handles grips, cuts and strips insulation.

BENCH TYPE CABLE STRIPPER

For cables up to ⅝" o.d., including solid or inflexible types.



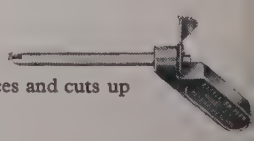


FOOT OPERATED WIRE STRIPPER

Ideal for small flexible cables up to ¼" o.d.

LITTLE SNIPPER WIRE CUTTER

Reaches into awkward places and cuts up to 16 s.w.g. copper wire.



FULL DETAILS FROM

J. B. HYDE & CO. LTD.

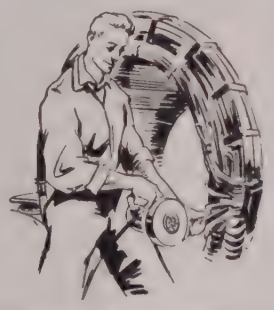
DALE STREET, BROADHEATH, ALTRINCHAM, CHESHIRE

Telephone: Altrincham 0842 Telegrams: "BRAIDING"

The Versatile MARTINDALE Blowers

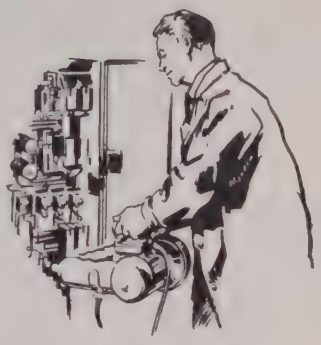
POWERFUL BLOWING

The powerful Martindale Blowers direct a stream of dust-removing air into every inaccessible crevice of electrical and other machinery, thus removing a common cause of short circuits and motor failures.



HOT AIR DRYING

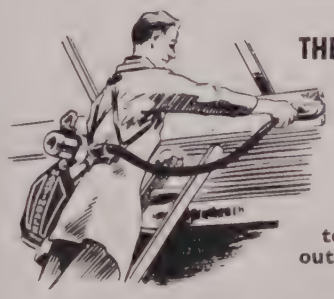
The "Simoom" independent Heater is available for attachment to the Blowers and produces hot air for the quick drying of coils, transformers and for many other purposes.





EFFICIENT SUCTION

All of the five blowers are instantly converted into portable industrial suction cleaners by the use of standard attachments at little cost.



THE "PORT-A-VAC" (regd.)

The "Port-A-Vac" (regd.) light-weight harness permits the Martindale Blower to be used as a powerful vacuum cleaner carried in comfort upon the operator's back leaving him free to climb ladders, etc., to clean out-of-reach parts of the factory.

"MARTINET" WET-DRY SUCTION PICK-UP

With this amazing equipment any Martindale Blower is converted into a suction cleaner which picks up both liquids and solids, the liquids and dirt being deposited into the special tank and only the airborne dust into the filter bag.



Every factory, works and stores has a task which can be performed by the versatile Martindale Blower. In removing harmful dust from all mechanical appliances, either by Suction or Blowing, machinery can be kept running longer and expensive overhaul avoided. For "drying-out" too, a Martindale Blower fitted with a "Simoom" Heater Unit saves hours.



Every Factory needs MARTINDALE BLOWERS

For full details of specifications of Martindale Maintenance Equipment write to :-

MARTINDALE ELECTRIC CO. LIMITED

4 Westmorland Road London N.W.9 Telephone:– COLindale 8642



for industrial control devices ...



- LIMIT SWITCHES
- INDICATOR LIGHTS
- MINISWITCHES
- METALCLAD MINISWITCHES
- PUSH BUTTONS
- ROTARY SWITCHES

A RANGE OF QUALITY CONTROL GEAR BUILT TO SATISFY THE DESIGNER AND ENGINEER

CONTROL DEVICES

CATALOGUE GIVING FULL DETAILS & PRICE LIST AVAILABLE ON APPLICATION

... consult CRAIG & DERRICOTT LIMITED

Telephone: SUTton Coldfield 7716-7-8

ROYAL WORKS, SUTTON COLDFIELD

HVE 3 kW, 5 kW and 10 kW FAN UNIT HEATERS

- Thermal Safety Switch
- Summer Ventilation
- Adjustable Louvres on 10 kW model
- Accessible for service
- Economical and easy to install



3 kW Fan Heater Unit £14.10.3. list (200/250 v A.C.)

5 kW Fan Heater Unit £19.3.9. list (346/440 v A.C.)

Specification

Casing: Aluminium Alloy of high tensile strength

Elements: High-grade Nickel Chrome. Black Heat, easily replaceable

Motor: Shaded Pole Single Phase with large bearing surface. Silent in operation

Finish: Polychromatic Bronze



10 kW Fan Heater Unit £29.0.6. list

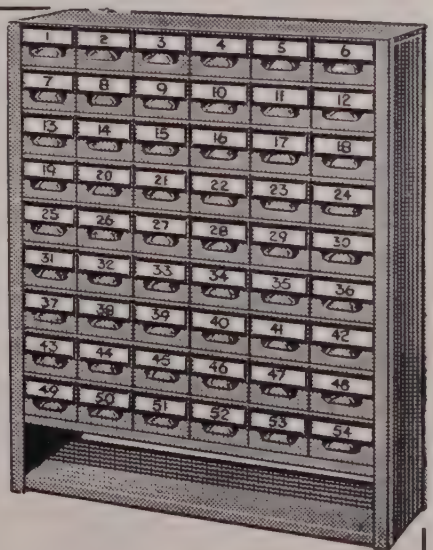
All types of space heating equipment supplied

H.V.E. (ELECTRIC) LTD.

Viaduct Works, Kirkstall Road, Leeds 4

Phone: Leeds 29315 (3 lines)

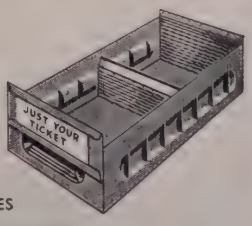
THE **"54"** DRAWER UNIT



ALL STEEL Stove Enamelled DARK GREEN

OVERALL SIZE
42" HIGH
35" WIDE
11¾" DEEP

Contains 54 of these drawers, each 5" wide 3" high 11¼" long. 54 dividers and 54 drawer cards with each unit. Extra dividers 6d. each.



£18 DELIVERED FREE to ENGLAND SCOTLAND and WALES

SEND FOR SAMPLE DRAWER

N. C. BROWN LTD.

ROCHDALE RD. WORKS · HEYWOOD · LANCS.

Telephone: Heywood 69018 (6 lines)

Hendrey Relays

NEUTRAL CURRENT INDICATOR

ALARM RELAY



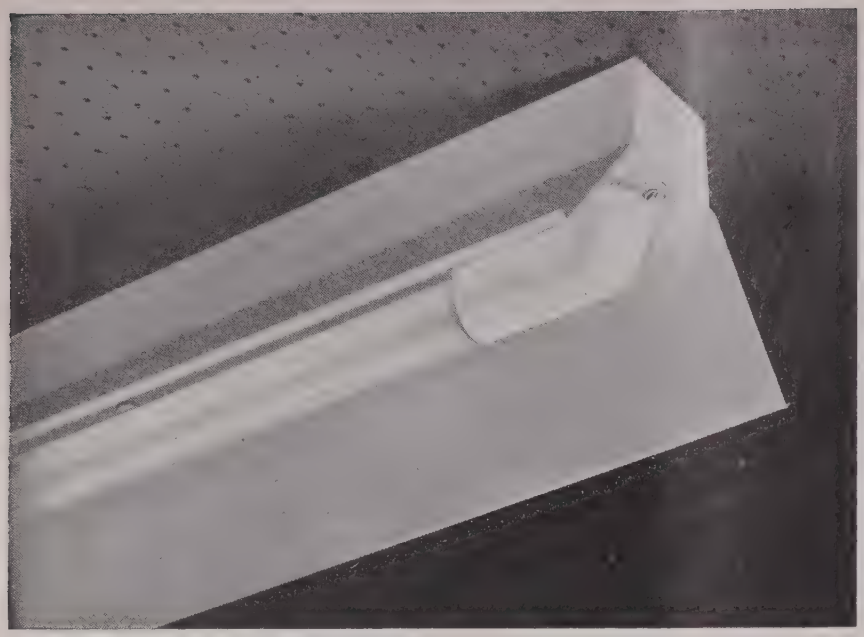
A.C. Coil
0·25 to 2·5 amperes.
250 to 110 milli-seconds.

HENDREY RELAYS LTD. BATH ROAD, SLOUGH, BUCKS.

Telephone: Burnham 609/611

MANUFACTURING ELECTRICAL ENGINEERS
CONTROL AND LABORATORY APPARATUS

On 'Admiralty, Principal Ministries and Post Office Lists, A.I.D. and A.R.B. approved



fluorescent lighting fittings

THIS VERY COMPETITIVE FITTING COMBINES SIMPLICITY WITH EFFICIENCY AND HAS ALL THE FEATURES TO MEET MODERN INSTALLATION REQUIREMENTS

key-hole fixing slots · suspension loops provided · full length back plate · three cable entry positions · captive screws retain reflector · resin filled control gear · switch or instant start · lamp end covers quickly detachable · control gear guaranteed 3 yrs. · 3 pin plug & socket extra

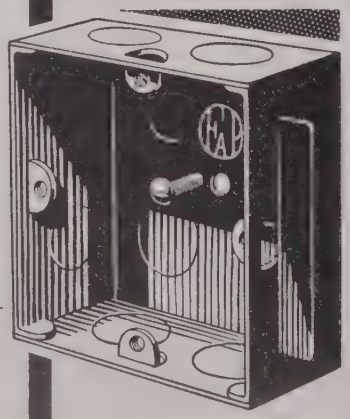
OT501 **£4-7-6** switch start less lamp

fitting brochure sent on request

WADES (HALIFAX) limited

ARDEN WORKS · FENTON ROAD · HALIFAX · YORKSHIRE

TEL: HALIFAX 61637

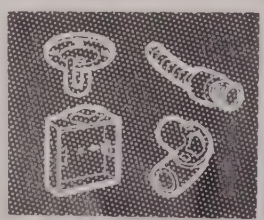


NEW FITTINGS FOR DRY PARTITION WALLS

APPROVED AND RECOMMENDED BY The British Plaster Board (Manufacturing) Ltd., Gyproc Products Ltd.

13 amp. Socket outlet or Switch Box. 2⅜" fixing centres for board or facings of ⅜" max. thickness. Also available in 2, 3 and 4 gang boxes.

Literature and price list by return



FITTER & POULTON LTD

TELEPHONE CALTHORPE 1151-2 · TELEGRAMS FAP BIRMINGHAM

Vincent Parade · Birmingham 12

WILLIAM ESTD. GEIPEL 1871 LIMITED

CONTROL GEAR

A.C. and D.C.

for all Industrial purposes

STARTERS
DIRECT ON LINE
PUSH BUTTON
REVERSING
STAR DELTA

REGULATORS
RESISTANCES
RELAYS
CONTACTORS
SWITCHES
ETC.

A full range of Standard Equipment. Special Equipment designed and made to Customers' requirements.

VULCAN WORKS · 156-170 BERMONDSEY ST · LONDON · S.E.1

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).

DISPLAYED CLASSIFIED:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Cheques and Postal Orders should be crossed and made payable to ILIFFE ELECTRICAL PUBLICATIONS LTD.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

Advertisements are accepted up to **first post on Monday** of the week of issue

If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

ELECTRICITY (ESSENTIAL SUPPLIES) ACT (NORTHERN IRELAND) 1954

CITY AND COUNTY BOROUGH OF BELFAST

Electricity Department

TENDERS are invited for the supply, delivery and erection of :—

Air Heater Element Cleaning Equipment at Belfast Municipal Electric Power Station West.

Form of tender (N.2484), conditions and specification, in quintuplicate, may be obtained from Messrs. Merz & McLellan, Consulting Engineers, Carliol House, Newcastle upon Tyne, 1, on payment of a deposit of five guineas, which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the tender document may be obtained at one guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Air Heater Element Cleaning Equipment, Electricity Department," and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, 1, so as to reach him not later than 4 p.m. on Friday, 3rd February, 1961.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

C. A. R. SHILLINGTON,
Chairman,
Northern Ireland Joint Electricity Committee.

7172

COUNTY OF THE BOROUGH OF CARMARTHEN

Improvement of Street Lighting

FIXED Price Tenders are invited for the removal of the existing Street Lighting Units and for the supply and erection of a Group "A" Street Lighting Installation comprising 109 140-watt Sodium Lighting Units complete with steel columns at the Western Section of the Trunk Road A.40 and Llanstephan Road B.4312.

Copies of the specification, bills of quantities and form of tender may be obtained from the Borough Engineer and Surveyor, Municipal Offices, John Street, Carmarthen, on payment of a deposit of £2 2s., which will be refunded on receipt of a bona fide tender not subsequently withdrawn. Drawings may be inspected at the office of the Borough Engineer and Surveyor during the normal office hours.

Tenders in plain sealed envelopes, endorsed 'Improvement of Street Lighting," and bearing no name or mark indicating the sender, must be delivered to the undersigned not later than 2 noon on Monday, 23rd January, 1961.

The Council do not bind themselves to accept the lowest or any tender.

D. MYRDDIN THOMAS,
Town Clerk.

Municipal Offices,
John Street, Carmarthen. 7181

CLASSIFIED ADVERTISEMENTS ARE PREPAID

NATO COMMON INFRASTRUCTURE

Slice VI

Naval Base Installations

FINAL NOTICE is hereby given that International Competitive Bids will be invited on or about the 28th April, 1961, for the following electrical installation work at a depot to be constructed in the Dumbartonshire area of Scotland.

(a) Installation only of 11-kV switchgear, supply and installation of transformers.
(b) High-voltage and medium-voltage mains cabling.
(c) Electrical installations in buildings.
(d) Lightning conductor installation.
(e) Cathodic protection.
(f) Street lighting.

2. The approximate cost of the contract is £100,000.

3. The work will be carried out as one contract which will be undertaken as a sub-contract within the framework of the Main Construction Contract.

4. It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for United Kingdom labour for the trade or industry in the same area.

5. The closing date for receipt of bids will be 28th June, 1961.

6. Firms wishing to bid must formally notify their desire by application to the address below by 28th February, 1961.

7. Within one week after the closing date for the receipt of applications to bid, firms wishing to be invited must forward the following information :—

(i) Statement of financial resources and evidence of financial stability.
(ii) Details of recent contracts for work of a comparable nature including an indication of the value of each.

8. Enquiries regarding bidding should be addressed to :—

Director General, Navy Works,
Admiralty,
Chamberlain Way, Pinner,
Middlesex, England,

quoting reference NATO C.I. Job No. 3 (Sub-Contract Electrical Installation). 7213

COUNTY COUNCIL OF ESSEX

Grays Thameside County Junior and Infants' Schools

Renewal of Electrical Installation

CONTRACTORS wishing to submit a firm price tender for the above should forward their names, from which a panel will be chosen and provided with tender documents.

The work consists of the renewal of the electrical installation, which is to be carried out during term time and to be completed by the end of July, 1961. The estimated cost of the contract is £2,100.

Applications to reach the undersigned not later than 14th January, 1961.

H. CONOLLY, C.B.E., F.R.I.B.A.
County Architect.

County Hall,
Chelmsford. 7214

BOROUGH OF EALING

Renewal of Electrical Installation at Stanhope Primary School, Mansell Road, Greenford, Middlesex

TENDERS are invited from approved N.I.C.E.C. contractors for the above-mentioned work. Specification and tenders from Borough Engineer, Town Hall, Ealing, London, W.5, on receipt of deposit of £1, returnable on receipt of bona fide tender.

Closing date 26th January, 1961.

E. J. COPE BROWN,
Town Clerk.

7192

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

MIDLANDS ELECTRICITY BOARD

Wolverhampton and District Sub-Area

MAINS FOREMAN (Wolverhampton). Duties will include control and supervision of cable laying staff and co-ordination of transport arrangements. Experience in control of a large manual labour force necessary.

Conditions of service and salary (£880 per annum, Schedule E, Grade 1) in accordance with N.J.I.C. Agreement.

Apply by letter, within 7 days, to District Manager, Midlands Electricity Board, 83, Darlington Street, Wolverhampton.

F. W. CATER,
Secretary. 7201

AIR MINISTRY

Works Designs Branch

requires in London and Provinces ENGINEERING DESIGNER DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution. Candidates should have served recognised apprenticeship or had equivalent training, and also have had practical experience. O.N.C. an advantage. Financial assistance and time off for recognised courses of study. Promotion and pension prospects. 5-day week with 18 days' paid leave per year initially. Overseas tours for which special allowances granted.

Salary in LONDON ranges from £805 (age 25) to £980 p.a.; somewhat lower in PROVINCES. Commencing salary dependent on age, qualifications and experience.

Applicants, who must be natural-born British subjects, should write quoting O/N Kings Cross 4354 to Air Ministry, W.G.d, Theobalds Road, London, W.C.1, or to any Employment Exchange, giving age, details of training, qualifications, full particulars of former posts held and copies of any testimonials. Candidates selected will normally be interviewed in London and certain expenses reimbursed. 250

***Situations Vacant** (continued)*

Applications are invited for the following positions by :—

JAMAICA PUBLIC SERVICE COMPANY LIMITED

Kingston, Jamaica, West Indies

ELECTRICITY GENERATION ENGINEER. Candidates will be required to take charge of the company's generating stations and should be experienced in the management, control, operation and economics of steam generating stations comprising units up to 50-MW capacity with oil-fired boilers. Company's car provided. Salary in the neighbourhood of £3,000 per annum. Excellent prospects.

PERSONAL ASSISTANT TO THE OPERATING MANAGER. Candidates should have had a good technical education and training and experience in the operation of generating stations and overhead and underground distribution systems. Company's car provided. Salary £2,000/£2,500 per annum depending upon experience. Excellent prospects.

FIRST ASSISTANT ENGINEERS. Candidates should have a good technical knowledge of and experience in the design, construction or maintenance of high-voltage overhead line electric supply systems and substations. Salary in the neighbourhood of £1,750 per annum or higher if qualifications warrant. Excellent prospects.

The above positions offer engineers an interesting career in a rapidly developing company. The company has a pension scheme. The usual term of service is 3 years with 3 months' holiday thereafter with passages paid.

Applications in duplicate outlining training and experience should be sent in confidence to A. H. Young, M.I.E.E., Chairman, Simpson, Baker & Co. Ltd., 240-260, Ferndale Road, London, S.W.9. 7176

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

CONSUMERS' ENGINEER required in the Anglesey District based on Holyhead. Salary within range £890/£1,015 per annum (N.J.B. E/8).

Applicants must have had a sound technical training, and experience within the industry in dealing with :—

(a) Designing and estimating for all types of electrical installation work.

(b) Advising consumers on tariffs, appliances and all aspects of electricity utilisation.

(c) Organisation of service centres and exhibitions.

(d) Control of manual and administrative staff.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, nr. Wrexham. Closing date, 20th January, 1961. 7204

ENGLISH ELECTRIC

ELECTRICAL ENGINEERS

required for the design of light and heavy current electrical/electronic gear on long term experimental projects related to the development of Nuclear Power Reactors.

The work calls for a good theoretical and practical background of all branches of Electrical Engineering. Two of these appointments require experience of closed loop automatic control systems and all computer facilities are available for this work.

Please write giving brief details of qualifications, experience and present salary to the

Technical Personnel Officer, Room 534

English Electric House, Strand, London, W.C.2

quoting reference ER1818E

7206

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

Assistant Engineers (Divisional Headquarters) Protective Gear Section

FOURTH ASSISTANT ENGINEERS are required in the Protective Gear Section of the Electrical Department.

N.J.B. Agreement conditions, superannuable appointment, salary within Schedule B, Class BX, either Grade 9, 10 or 11, according to qualifications and experience. The salary ranges are as follows :—

Grade 9 : £1,005 - £1,325 per annum.
Grade 10 : £935 - £1,245 per annum.
Grade 11 : £855 - £1,165 per annum.

Candidates should possess a University Degree, Higher National Certificate in Electrical Engineering or an equivalent qualification, and should preferably have some knowledge of protective gear. Experience with a switchgear manufacturer would be an advantage.

Apply, quoting Vacancy No. 344/60MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, to reach him not later than 16th January, 1961. 7223

AIR MINISTRY

STATION ENGINEERS (G.D.) and STATION ENGINEERS (Mech.) required at R.A.F. and Ministry of Aviation stations throughout the United Kingdom. The work of Station Engineers (G.D.) consists of installation, operation and maintenance of high and medium-voltage electrical distribution systems, electrical power and lighting installations, control systems and generating plant; knowledge of heating and ventilating plant and diesel engines an advantage. Station Engineers (Mech.) are concerned with diesel power plant, steam and hot water heating systems, refrigeration and air conditioning and miscellaneous workshop plant, tools and equipment.

Candidates should hold O.N.C. Elec. or Mech./C. and G. Electrical Technicians Certificates/2nd Class M.O.T. Certificate or equivalent, and must also have had recognised apprenticeship with firm of good repute plus 3 years' employment in electrical or mechanical and engineering, preferably on operation and maintenance of mine, factory or workshops plant and services. Preference to candidates with supervisory experience.

Commencing salary, which is dependent upon age, qualifications and experience, ranges from £745 (age 25) to £925 max. in Grade III. There are pension prospects and also opportunities of advancement to numerous posts in the higher grades vacancies which, as a rule, are filled by promotion of Grade III staff, viz.:—

Technical Grade II ..... £925-£1,055 (276 posts)
Inspector of Works Grade I £1,055-£1,295 (137 posts)
Technical Grade B ..... £1,295-£1,491 (25 posts)
Technical Grade A ..... £1,385-£1,630 (17 posts)

Overseas tours for which special allowances ranging at present up to £1,800 p.a. are payable in addition to a higher salary. Internal training courses are provided and financial assistance and time off is allowed for recognised courses of study leading to higher qualifications. 5-day week with 18 days' paid leave a year initially.

Applicants, who must be natural-born British subjects, up to age 55, should write stating age, qualifications and experience to the Manager (P.E.1), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. No original testimonials should be sent. Candidates selected will normally be interviewed in London and certain expenses reimbursed. Only applicants selected for interview will be advised. 249

IMPERIAL SMELTING CORPORATION LIMITED

ASSISTANT ELECTRICAL ENGINEER SWANSEA VALE

Applications are invited from suitably qualified engineers aged 23-35 for the position of ASSISTANT ELECTRICAL ENGINEER at the above Corporation's Swansea Works. The duties will involve assistance in the supervision and carrying out of electrical maintenance and repair work, installation of new equipment and advising on suitability of electrical equipment.

Candidates who are Graduate Members of the Institution of Electrical Engineers with three years' electrical supervisory experience will be considered, but a B.Sc. or Associate membership of the Institution of Electrical Engineers is desirable.

Applications should be marked "Confidential" and submitted, quoting reference ER/ASEE, to :—

Personnel Manager

IMPERIAL SMELTING CORPORATION LTD.

St. Andrew's Road, Avonmouth 7166

DRAUGHTSMEN

ENGLISH ELECTRIC, WHETSTONE, NR. LEICESTER

A large number of mechanical and electrical draughtsmen are required for the Atomic Power Division. Men with at least O.N.C., preferably H.N.C. (mechanical or electrical) and a minimum of three years' drawing office experience in mechanical engineering or electrical engineering connected with plant layout or machinery design are invited to apply.

These are excellent openings in a rapidly expanding organisation with the consequent possibility of further financial advancement as experience is gained in this field.

The work covers a wide field of engineering concerned with the design of the Hinkley Point and Sizewell Nuclear Power Station contracts and with tender designs for contracts at home and overseas which are yet to be placed.

Married men who are prepared to purchase a house but are unable to do so due to lack of sufficient capital should not be discouraged from applying for these positions.

Please write, giving brief details of qualifications, experience and present salary to:

GROUP PERSONNEL SERVICES

ENGLISH ELECTRIC COMPANY LTD.

ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2

Please quote reference number ER1899P

7164

NORTH WESTERN ELECTRICITY BOARD

District Commercial Engineer, Macclesfield District

DUTIES will include the organisation and control of commercial staff and functions in the District, which is mainly residential and rural with some light industry; supply of information and advice to consumers on all commercial matters; control of contracting section, service centres and exhibitions. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,650/£1,830 p.a., Grade H.2. N.J.B. conditions.

Applications must be made on a form to be obtained from the Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, and returned to him so as to be received not later than 21st January, 1961. 7186

CONTROLS DRAUGHTSMEN

required by

BLACK-CLAWSON INTERNATIONAL LTD.

18/19, Savile Row, London, W.1

DRAUGHTSMEN required in Controls Section of large mechanical engineering company manufacturing machinery for paper production and converting industry.

Ideal applicants will have served recognised apprenticeship, preferably with electrical manufacturer, hold an O.N.C.E.E., and be fully conversant with automatic control schemes. Experience in pneumatic instrumentation and/or hydraulic systems an added advantage.

Permanent and progressive position, pension and bonus schemes in operation.

Apply in writing giving full particulars to the Electrical Engineer at the above address.

7167

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

Senior Assistant (Prepayment Section), Accountancy Department, Area Headquarters

APPLICATIONS are invited for the appointment of SENIOR ASSISTANT (Prepayment Section), Accountancy Department. Salary in accordance with the National Joint Council Agreement, Grade 5, £1,020/£1,140 per annum.

Applicants should have had experience in the Income Section of a Public Utility Undertaking and have knowledge of prepayment meters and necessary accounting connected therewith.

Preference will be given to persons holding recognised qualifications.

Application forms, which may be obtained from the undersigned, should be returned to this office duly completed not later than seven days from the appearance of this advertisement.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton. 7251

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER is required at Ironbridge Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade J.9, £1,115-£1,245 per annum, plus 10% shift duties.

A sound technical training and practical power station experience are required in the operation of steam generating plant and main switchgear. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 345/60MD, on forms AE6, available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, to be completed and returned not later than 16th January, 1961.

F. W. SKELCHER,
Divisional Controller.

7222

London County Council

PADDINGTON TECHNICAL COLLEGE

Saltram Crescent, London, W.9

REQUIRED, 10th April, 1961: LECTURER to be responsible to the Head of the Engineering Department for all Electrical Engineering Courses.

Courses include Ordinary National Certificate, City and Guilds Electrical Installation Courses "B" and "C," and City and Guilds Electrical Technicians' Course.

Salary (Burnham scale) £1,370 × £35/£40 to £1,550.

Particulars and form from Secretary.

Please quote (FE3a/E/3310/1). 7203

COMMERCIAL ENGINEER

(ELECTRICAL)

ELECTRICITY DEPARTMENT SIERRA LEONE

QUALIFICATIONS: Candidates (age 30-45) must be A.M.I.E.E., with experience in budgeting, control of revenue and expenditure and forecasting of expenditure and capital requirements.

DUTIES: To be responsible for implementation of tariffs negotiations and preparation of special agreements, sales control of stores policy, investigation and preparation of cost analysis, and all activities of a commercial nature associated with the sale of electricity.

TERMS OF APPOINTMENT: On contract for 3 tours of 18-24 months in salary scale £2,300-£2,450 with 15% gratuity. Outfit allowance. Children's allowance. Free passages. Quarters normally available at low rental. Generous leave.

Write to Director of Recruitment, Colonial Office, London, S.W.1, giving full names, age, qualifications and experience, quoting BCD.145/15/08/D11.

7200

Situations Vacant (continued)

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Standardisation)

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class H, Grade 6 (£1,275-£1,410 per annum). N.J.B. conditions of service.

The duties of the post will include responsibility to the District Commercial Engineer for the planning, organisation and supervision of the work involved on consumers' installations and apparatus of approximately 3,000 D.C. and 42,000 non-standard A.C. consumers in the Southampton District, who are to be transferred to standard voltage A.C. supply. Wide experience in installation practice and apparatus conversion is essential. Experience on changeover work and the possession of suitable technical qualifications will be advantages.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1301, not later than 16th January, 1961.

Assistant Engineer (Standardisation)

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class H, Grade 9 (£1,040-£1,165 per annum). N.J.B. conditions of service.

The duties of the post will include working under the Grade 6 Assistant Engineer (Standardisation) who will be responsible to the District Commercial Engineer for the planning, organisation and supervision of the work involved on consumers' installations and apparatus of approximately 3,000 D.C. and 42,000 non-standard A.C. consumers in the Southampton District, who are to be transferred to standard voltage A.C. supply. Wide experience in installation practice and apparatus conversion is essential. Experience on changeover work and the possession of suitable technical qualifications will be advantages.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1302, not later than 16th January, 1961.

Assistant Engineer (Maintenance and Operation)

Melksham District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class G, Grade 9 (£965-£1,090 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks., and returned to him, quoting Z.1291, not later than 16th January, 1961.

Installation Assistant

Uxbridge District of No. 1 (Southall) Sub-Area. Salary N.J.B. Class G, Grade 11 (£825-£940 per annum, plus London allowance). N.J.B. conditions of service.

Applicants should have had experience in the preparation of specifications and estimates for all types of electrical installations, and should be competent to supervise electricians and organise the allocation of work.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1300, not later than 16th January, 1961.

Surveyor

Yeovil District of No. 4 (Bournemouth) Sub-Area. Salary N.J.C. 2 (£700-£775 per annum). N.J.C. conditions of service.

A sound knowledge and experience of general survey work with ability to peg overhead lines and prepare profiles and plans from surveyed elevations are required.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1284, not later than 16th January, 1961.

Demonstrator

Yeovil District of No. 4 (Bournemouth) Sub-Area, located at Shaftesbury. Salary N.J.C. Grade 1 (£600-£700 per annum). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus, and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1285, not later than 16th January, 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 7225

ELECTRICAL TECHNICIANS

TECHNICAL ASSISTANTS GRADE II (Electrical) required by KENYA GOVERNMENT for 1 tour of 36/45 months in first instance. Salary according to age and experience in scale (including inducement pay) rising to £1,173 a year. Gratuity 13½% of total salary drawn. Outfit allowance £40. Free passages. Liberal leave on full salary. There is a Salary Commissioner at present in East Africa and an increase in salary is likely.

Candidates, under 45 years of age, must have served full apprenticeship and have had subsequent experience of wiring, cable jointing, overhead line work and general maintenance. They must be capable of installation and supervision of electrical work on building projects and able to instruct junior staff.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2A/51133/EF. 7194

CENTRAL ELECTRICITY GENERATING BOARD

SENIOR ASSISTANT ENGINEER

required in the Nuclear Operations Branch of the Operations Department at Headquarters, London, S.E.1.

The work of the Nuclear Operations Branch includes co-ordinating, with the Operating Regions, the commissioning, operation and maintenance of the Board's nuclear power stations, design liaison and liaison with the Nuclear Health and Safety Department.

Candidates should possess an engineering degree or equivalent qualification and have sound practical experience in the commissioning, operation and maintenance of power stations or similar plant. Experience of nuclear plant, though desirable, is not essential.

Salary within the range £1,710-£2,455 p.a., according to duties and responsibilities.

Applications stating age, qualifications, experience, present position and salary to the Personnel Officer, 24/30, Holborn, London, E.C.1, by 30th January. Envelopes should be marked "Confidential, Ref. ER/473." 7220

THE LUMMUS COMPANY LIMITED

Imperial House, 80 Regent Street, London, W.1

Designing Engineers and Constructors for Industry

invite applications for the following staff :—

ELECTRICAL ENGINEERS

Applicants should be 28 years of age or over and have experience in power, lighting and control wiring in the petrochemical field and be experienced in Design Team Control. Technical qualification graduate I.E.E. This is a Senior position and salary will be commensurate with experience, etc.

ELECTRICAL CHECKER (DESIGNERS)

Applicants should have H.N.C. or equivalent and have 3 years or more experience in power, lighting and/or control designs in the oil refinery or chemical fields.

SENIOR ELECTRICAL DESIGN DRAUGHTSMEN

Applicants should have H.N.C. or equivalent and have 3 years or more experience in power, lighting and/or control designs for industrial work preferably in the oil refinery or chemical fields.

Five-day week. Sickness and pension schemes. Luncheon and Social clubs where subsidised meals are obtainable.

Apply in Writing to the Personnel Officer.

7183

LONDON ELECTRICITY BOARD

General Assistant Engineer

APPLICATIONS are invited for the above position. Initially the successful candidate will be located at 154, Uxbridge Road, Shepherds Bush, W.12.

Applicants should have a sound technical education to the standard of the Higher National Certificate and have completed a recognised period of training in the electricity industry, or have equivalent experience.

Pending determination as to the grading and salary applicable to the post within the National Joint Board Agreement, the provisional minimum salary will be £685 per annum, rising to £855 per annum inclusive of London allowance.

Applications should be sent direct to the Manager, Western District at the above address, within 14 days of the publication date of this notice. Please quote ref. PER/V/3109/R. 7235

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

TRAINEE DEMONSTRATOR required in the Caernarvon District. Salary within range £265/£565 per annum, according to qualifications and experience, providing £320/£350 per annum approximately at 18/19 years of age.

Applicants should have completed a full-time course of not less than two years at a domestic science training centre, and be prepared to continue with studies. A knowledge of electrical appliances will be an advantage. Ability to speak Welsh desirable.

Promotion to Demonstrator will depend on vacancies existing on completion of training, which would be approximately three years.

Appointment subject to medical examination.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, nr. Wrexham, or from any District Office. Closing date 25th January, 1961. 7227

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

(a) THIRD ASSISTANT ENGINEER, Bedford District (344/60.N).
(b) THIRD ASSISTANT ENGINEER, Hemel Hempstead District (345/60.R).
(c) SECOND ASSISTANT ENGINEER, Aylesbury District (342/60.R).

Candidates should have had a sound technical training and considerable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems including substations.

Salary :—
(a) N.J.B. Class G, Grade 9 (£965 - £1,090)
(b) N.J.B. Class F, Grade 9 (£890 - £1,015)
(c) N.J.B. Class F, Grade 7 (£1,040-£1,165)

Apply by letter, by 20th January, 1961, as follows :—
(a) The Manager, Bedford District, Eastern Electricity Board, Prebend Street, Bedford.
(b) The Manager, Hemel Hempstead District, Eastern Electricity Board, Bridge Street, Hemel Hempstead, Herts.
(c) The Manager, Aylesbury District, Eastern Electricity Board, Exchange Street, Aylesbury.

Northmet Sub-Area

THIRD ASSISTANT ENGINEER, Hornsey District (343/60.R) (Ref. 1026).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class G, Grade 9 (£965-£1,090) plus London allowance.

Apply by letter to C. Bradley, M.I.E.E., Manager, Eastern Electricity Board, The Broadway, Crouch End, London, N.8, by 20th January, 1961.

Suffolk Sub-Area

FOURTH ASSISTANT ENGINEER (Planning and Development Section), Sub-Area Headquarters (341/60.N).

The duties of the post are mainly field planning and assistance with the design of L.V. and H.V. systems. Candidates should have had a sound technical training and experience in the construction and operation of urban and rural distribution networks, at voltages up to 33 kV.

Candidates should preferably have obtained the Higher National Certificate in Electrical Engineering or its equivalent.

The successful candidate will be required to reside within reasonable proximity to Stowmarket.

Salary N.J.B. Class K, Grade 13 (£890-£1,015).

Apply by letter to the Manager, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, Suffolk, by the 20th January, 1961.

THIRD ASSISTANT ENGINEER, Clacton District (346/60.N).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems, including substations, at voltages up to and including 33 kV.

Salary N.J.B. Class E, Grade 9 (£825-£940).

Apply by letter to S. N. Boyne, A.M.I.E.E., Manager, Clacton District, Eastern Electricity Board, 56/58, Station Road, Clacton-on-Sea, Essex, by 20th January, 1961. 7215

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT (Wayleaves), Woking District. Salary £700 × £25 to £775 per annum under N.J.C. Grade 2. Superannuable. Applicants should possess tact and personality and be experienced in work connected with the negotiation of wayleaves and substation sites.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 4, Chobham Road, Woking, by 18th January, 1961.

GEORGE WRAY,
Secretary. 7230

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

DESIGN DRAUGHTSMEN

If you have . . .

A Higher National Certificate
Good Workshop Experience
Experience in Electrical or Mechanical design

You are invited to apply for a position as:

ASSISTANT DESIGN ENGINEER

The work is varied and offers experience leading to opportunities for advancement to a Design Engineer for those able to take responsibility. Previous experience of nuclear work is not essential. The salary will be in the range £930-£1,340 according to age and experience.

If you have . . .

An Ordinary National Certificate
At least three years' Workshop Experience
Drawing Office experience

You are invited to apply for a position as:

DRAUGHTSMAN

The work is varied and offers experience leading to opportunities for advancement to an Assistant Design Engineer. The salary will be in the range £610-£1,020 according to age and experience.

If you are . . . .

interested then please write for further details to the Personnel Officer, Rutherford High Energy Laboratory, Harwell, Didcot, Berkshire, quoting Ref. : VN23/48. 7165

AIR MINISTRY

ASSISTANT MECHANICAL AND ELECTRICAL ENGINEERS required for design, construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for the R.A.F. at home and overseas as well as certain Civil Airports.

Salary £805 at 25 to £1,095 at 34 or over, thereafter rising to max. £1,260 with increase for London and slight decrease for country districts. Appointments long term with promotion and pension prospects. 5-day week with 4 weeks 2 days leave a year initially. Special allowances payable in addition to salary during overseas service.

Minimum qualifications and experience :—
(i) (a) University degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship; or
(b) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship; or
(c) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience, with at least 3 years' apprenticeship; and
(ii) have been employed for minimum of 2 years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural-born British subjects between the ages of 25 and 45. Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.158/OA. 248

VACANCY FOR TECHNICIAN

MINISTRY OF AVIATION, Regents Park, London, requires TECHNICIAN to supervise contractors' approved inspection organisation covering airborne and ground electrical equipment. Qualifications: recognised engineering apprenticeship or equivalent training, O.N.C., C. and G. Final Certificates or equivalent. Experience of inspection and test of electrical equipment.

Salary £975-£1,115. Technical college course sponsored for suitable candidates. Good prospects for promotion and pension.

Application forms from Manager (PE.3778), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. 7169

MANAGER CABLE SALES DIVISION

required for old-established rubber and plastic cable manufacturers. For this important position salary will be commensurate with ability.

Applications which will be treated in strict confidence, giving full particulars of experience and career in this field should be sent to:

The Managing Director
GREENGATE & IRWELL RUBBER CO. LTD.
Greengate Works, Manchester, 3

7240

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A and B. Salary includes London allowance.

FOURTH ASSISTANT ENGINEER (Development), ELECTRICAL DEPARTMENT, DEVELOPMENT SECTION, DIVISIONAL HEADQUARTERS, GENERATION HOUSE (Vacancy No. 60/1011).

Candidates should possess academic qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers. Familiarity with methods of solving short circuit power flow problems on high-voltage transmission systems will be an advantage. Salary Class BX, Grade 11 = from 1.7.60, £905-£1,215 per annum; from 1.7.61, £950-£1,215 per annum.

THIRD ASSISTANT ENGINEER (Telecommunications), ELECTRICAL DEPARTMENT, DIVISIONAL HEADQUARTERS, LOCATED AT NATIONAL CONTROL CENTRE, BANKSIDE HOUSE, LONDON, S.E.1 (Vacancy No. 60/1012).

Applicants should possess a Higher National Certificate or equivalent qualification and should have had considerable experience of the installation, testing and maintenance of telecommunication equipment such as automatic telephony, line signalling and telemetering systems. A knowledge of the Generating Board's Standardised Central Indicating System would be an advantage. Salary Class BX, Grade 8 = from 1.7.60, £1,155-£1,460 per annum; from 1.7.61, £1,195-£1,460 per annum.

ASSISTANT STATION CHEMIST, BLACKWALL POINT POWER STATION (Vacancy No. 60/1013).

Candidates should preferably hold H.N.C. (Chem.) and have had experience in analysis of coal, oil and water, together with other chemical duties required in a power station. Salary Class G, Grade 9 = £1,015-£1,140 per annum.

Applications, quoting vacancy number, to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 17th January, 1961. 7196

EASTERN REGIONAL HOSPITAL BOARD (SCOTLAND)

APPLICATIONS are invited for the appointment of DEPUTY REGIONAL ENGINEER on the Headquarters Staff of the Board. Candidates must be Corporate Members of the Institution of Civil, Mechanical or Electrical Engineers and have considerable experience in the design, installation and servicing of engineering services and works in hospitals. The duties of the appointment are to deputise for the Regional Engineer over the whole range of his duties, including the day-to-day supervision of the Regional Engineer's Department.

Salary scale £1,450 to £1,770 per annum.

Applications giving age, training, qualifications, past and present appointments, experience and the names and addresses of three referees to the Secretary, Eastern Regional Hospital Board, Vernonholme, Riverside Drive, Dundee, not later than 14th January, 1961. 7187

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

CONTRACTING ENGINEER required in the Southport District. Salary within range £890/£1,015 per annum (N.J.B. F/9).

Candidates should possess technical qualifications in electrical engineering and have had experience of electrical contracting, including estimating and supervision of work on site.

Appointment subject to medical examination. Pension scheme.

Special application forms, obtainable from the Manager, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3, should be returned not later than 20th January, 1961. 7228

CASTRIES TOWN COUNCIL

VACANT POST OF

ELECTRICAL ENGINEER

APPLICATIONS are invited for the vacant post of ELECTRICAL ENGINEER, Castries area, ST. LUCIA, on the following terms and conditions:—

1. The post, which is pensionable under existing Civil Service regulations, is in the salary scale £1,000-£1,500 × £25 per annum. Appointment at a figure above the minimum may be made according to the qualifications and experience of the applicant selected.

2. Applicants should hold a university degree or equivalent diploma in electrical engineering or be Associate Members of the Institution of Electrical Engineers, and should have at least three (3) years' experience in a responsible position with a well-established engineering concern, including experience in the operation and maintenance of diesel engines. Consideration will, nevertheless, be given to applicants not having the academic or professional qualifications stated, but with considerable experience of a high standard.

3. The selected applicant will be required to assume responsibility for the power station and the Council's electric lighting system. He will also be required to lay down any new engines at the power station and carry out any extensions to the existing electrical system, or any other duties pertaining to the generating and distribution of electricity that may be assigned to him by the Council.

4. Free first class passages to St. Lucia will be provided for the selected applicant, his wife and not more than three (3) children, who must be unmarried, under 18 years of age, and dependent on the applicant.

5. Vacation leave is earned at the rate of twenty-eight (28) days per annum, and may be accumulated to a maximum of eighty-four (84) days.

6. Alternatively the successful applicant may be appointed on a three (3) year contract with the possibility of pensionable employment on completion of his contract.

7. The successful applicant will be required to assume his duties on 1st April, 1961.

8. Applications should be addressed to the Town Clerk, Castries Town Council, St. Lucia, West Indies, and should reach him not later than 31st January, 1961.

7174

THE BRITISH ELECTRICAL & ALLIED MANUFACTURERS' ASSOCIATION

APPLICATIONS are invited from qualified men within the age bracket 30/35 for the post of TECHNICAL ASSISTANT in the Switchgear Department at Ascot. Applicants should have :—

(a) A good educational background.
(b) Experience with switchgear and ancillary equipment.
(c) Administrative ability, personality and tact.

Some familiarity with the work of technical committees and the production of specifications would be an advantage.

A salary will be paid commensurate with qualifications and experience. There is a contributory staff superannuation scheme.

Applications should be addressed to the Secretary of the Association, 36, Kingsway, London, W.C.2. 7184

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments :—

ASSISTANT SHIFT CHARGE ENGINEER, TIR JOHN POWER STATION, SWANSEA (Vacancy No. 330/ER/60).

Salary Class H, Grade 9, Scale 8 (£1,040 to £1,165 per annum), plus 10% shift enhancement.

ASSISTANT SHIFT CHARGE ENGINEER, UPPER BOAT POWER STATION, Nr. PONTYPRIDD, GLAM. (Vacancy No. 331/ER/60). (RE-ADVERTISEMENT)

Salary Class H, Grade 9, Scale 8 (£1,040 to £1,165 per annum), plus 10% shift enhancement.

Previous applicants need not re-apply.

STATION SHIFT CONTROL ENGINEER, ABERTHAW POWER STATION, THE LEYS, Nr. BARRY, GLAM. (Vacancy No. 332/ER/60).

Salary Class L, Grade 10, Scale 10 (£1,190 to £1,325 per annum), plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a modern power station.

FOURTH ASSISTANT ENGINEER, TECHNICAL DEPARTMENT, DIVISIONAL HEADQUARTERS, CARDIFF (Vacancy No. 333/ER/60).

Salary Class A, Grade 11, Scale 7 (£855 to £1,090 per annum).

Applicants should have served an engineering apprenticeship and should preferably have had subsequent experience with a large electrical manufacturing firm or in the electricity supply industry.

The successful applicant will be employed on interesting problems in generating stations and on the 132-kV Grid.

Applicants should possess an electrical engineering Degree or H.N.C.

Special application forms are obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 14th January, 1961. 7195

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

South Staffs. and North Worcs. Sub-Area

GENERAL ASSISTANT DISTRICT ENGINEER (Smethwick/West Bromwich).

Applicants should have suitable technical qualifications and training in engineering duties associated with electricity distribution systems.

Salary £965/£1,090 per annum (N.J.B. Grade K.12).

Apply by letter, within 10 days, stating age, experience, present position and salary to Mr. H. A. P. Caddell, Sub-Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton, Staffs.

Worcester and District Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (Redditch/Bromsgrove).

Duties involve the construction, maintenance and operation of H.V. and L.V. distribution systems. Technical qualifications desirable.

Salary £965/£1,090 per annum (N.J.B. Grade G.9).

Apply by letter, within 14 days, stating age, qualifications, experience, present position and salary to Mr. E. B. Willis, District Manager, Midlands Electricity Board, Windsor Road, Redditch, Worcs.

F. W. CATER,
Secretary. 7202

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

ROTHERHAM AND MEXBOROUGH DISTRICT
ASSISTANT CONSUMERS' ENGINEER.

Applicants should possess a Higher National Certificate in Electrical Engineering or equivalent qualification.

Candidates should be capable of carrying out negotiations with consumers for new and additional supplies and have a sound knowledge of tariffs and their appropriate applications. They should have had experience of general load development, be fully conversant with the wiring rules and regulations of the I.E.E. and be capable of controlling staff and workpeople.

Salary N.J.B. Class K, Grade 10 (Scale 9), £1,115/£1,245 per annum.

Applications together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, No. 3 (Sheffield) Sub-Area, Commercial Street, Sheffield, 1, not later than 20th January, 1961.

Head Office

ASSISTANT ENGINEER
COMMERCIAL DEPARTMENT.

An assistant engineer is required in the development section of the commercial department to assist with technical sales matters. Applicants should be capable of writing technical reports, helping with matters needing a knowledge of I.E.E. and Statutory Regulations concerning electrical installations. They should have a knowledge of British Standards, Codes of practice and safety regulations. The possession of a recognised electrical qualification would be an advantage.

Salary N.J.B. Class BX, Grade 11, £855/£990 (transitional) to Scale 8, £1,040/£1,165 per annum.

Applications together with the names of two referees, should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Leeds, not later than 20th January, 1961.

No. 7 (Grimsby) Sub-Area

GAINSBOROUGH DISTRICT
SECOND ASSISTANT DISTRICT ENGINEER.

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers, or hold an equivalent qualification. They must have had a sound training and extensive experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems in rural and urban areas, substation plant and ancillary equipment.

Salary N.J.B. Class E, Grade 7 (Scale 7), £965/£25/£1,090 per annum.

SUB-AREA HEADQUARTERS
METER TESTER.

Applicants should have had experience of testing single-phase credit and prepayment meters and polyphase kWh meters.

Experience of trivector meters and kVA demand indicators would be an advantage.

Rate of pay, Group G of Schedule A of the N.J.I.C. Agreement. Present rate, 66.75d. per hour, 42-hour, 5-day week.

Applications together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, No. 7 (Grimsby) Sub-Area, Moss Road, Grimsby, not later than 20th January, 1961. 7232

LONDON ELECTRICITY BOARD

Assistant Distribution Engineer

APPLICATIONS are invited for the above position in the Board's Surrey Suburban District at Electricity House, Durnsford Road, Wimbledon, London, S.W.19.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 12, £875 per annum rising to £990 per annum, inclusive of London allowance.

Applications should be sent direct to the Manager, at the above address, within 14 days of the publication date of this notice, quoting ref. PER/V/3178/R. 7234

ELECTRICAL SHIFT CONTROL ENGINEER

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY, PRODUCTION GROUP

requires a

TECHNICIAN

AT CAPENHURST WORKS, CAPENHURST, CHESTER

to be responsible to the Electrical Operation Control Engineer for:—

(a) Operation of 132-kV switchgear, supervisory control of a number of large substations in accordance with instructions issued by the C.E.G.B. Grid Control Centre, and operation and control of E.H.V., H.V. and M.V. switchgear and ancillary equipment on the extensive power networks associated with this large and continuously operating chemical engineering works.

(b) Supervision of shift control and substation staff, issue of operational instructions and permits and preparation of statistics and electrical information.

A recognised electrical engineering apprenticeship, some years' experience in the control of large power networks with either a public electricity supply authority or a large industrial undertaking, and experience in the control of staff and industrial employees are required. A good working knowledge of the various designs of switchgear, E.H.V., H.V. and M.V., and of all ancillary equipment, including protective systems, experience in the operation of a permit-to-work certificate system, and a sound knowledge of the electricity regulations are also essential. Possession of H.N.C. in Electrical Engineering and a C.E.A. Authorisation, or their equivalents, may be an advantage.

Salary will be assessed within the scale £1,410-£1,630 according to qualifications and experience.

Contributory pension scheme.

Housing or assistance towards legal expenses on house purchase may be available.

Send POSTCARD for application form, quoting reference CAP.260/J.7, to Personnel Manager, at the above address.

Closing date, 16th January, 1961.

7168

EAST MIDLANDS ELECTRICITY BOARD

Lincolnshire Sub-Area

DEMONSTRATOR, Stamford District (Vacancy No. 148/60). Salary N.J.C. Grade 1, £600 × £25 to £700 per annum.

Applicants must be over 21 years of age and should hold the E.A.W. Electrical Housecraft Certificate for Demonstrators, and be experienced in general service centre duties and be capable of conducting demonstrations and advising consumers on the selection and use of electrical appliances, both at the service centre and on consumers' premises.

A car will be provided by the Board and the successful applicant will be based at the District Office and required to reside in or near the Borough of Stamford. Ability to drive a motor vehicle will be an advantage.

Applications should be forwarded to the Manager, Stamford District, 14, Barn Hill, Stamford, within fourteen days of the date of this advertisement. 7233

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Essex Sub-Area

CHELMSFORD DISTRICT
THIRD AND FOURTH ASSISTANT ENGINEERS

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems including substations.

Salary Third Assistant, N.J.B. Class F, Grade 9 (£890-£1,015) (335/60/R.); Fourth Assistant, N.J.B. Class F, Grade 11 (£765-£870) (336/60/R.).

Apply by letter to D. H. Walker, A.M.I.E.E., Manager, Eastern Electricity Board, Anchor Street, Chelmsford, Essex, by 13th January, 1961.

Norfolk Sub-Area

SUB-AREA-HEADQUARTERS
THIRD ASSISTANT ENGINEER (Mobile) (337/60/N.).

The successful applicant will be based in the Sub-Area Engineer's Department at Norwich, but will be required to operate anywhere within the Norfolk Sub-Area as required.

Candidates should have had a sound technical training and experience in the planning, construction, operation and maintenance of overhead and underground distribution systems, including substations.

Salary N.J.B. Class K, Grade 10 (£1,115-£1,245).

Apply by letter to the Manager, Norfolk Sub-Area, Eastern Electricity Board, 4, Duke Street, Norwich, by 13th January, 1961.

Northmet Sub-Area

ST. ALBANS DISTRICT
SENIOR SALES REPRESENTATIVES (4 posts) (338/60/R.)
(Ref. 828, 919 and 973).

Candidates must have had a sound practical training with experience in electrical installation work for domestic and commercial premises. A good knowledge of electrical water heating and ability to prepare wiring specifications and estimates is required with an all-round knowledge of, and an ability to sell, domestic electric appliances.

Salary N.J.C. Grade 2 (£700-£775).

Apply by letter to F. J. Drake, Assoc.I.E.E., Manager, Eastern Electricity Board, 107, St. Peter's Street, St. Albans, by 13th January, 1961. 7216

NORTH WESTERN ELECTRICITY BOARD

Senior Assistant (Sales Superintendent) North District, Salford

APPLICANTS should be experienced in the supervision of service centres, organisation of exhibitions, demonstrations and displays. The successful candidate will be responsible for domestic and commercial development, and the supervision of staff engaged on that work. Ability to develop business is essential.

Salary scale, £1,150 × £30 to £1,240 p.a. Grade 6. N.J.B. conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy). No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, 2, P.O. Box 493, and returned to him by 16th January, 1961. 7236

NORTH WESTERN ELECTRICITY BOARD

Fourth Assistant District Engineer, Stockport District

DUTIES include assisting with the operation, construction and maintenance of the distribution system within the District, both underground and overhead, including substations up to 33 kV.

The successful applicant will be required to undertake standby duty and should preferably be suitably qualified.

Salary scale £825/£940 p.a., Grade G.11. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, and returned to him not later than 14th January, 1961. 7185

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

SHIFT CHARGE ENGINEER, BURTON-ON-TRENT POWER STATION
(Vacancy No. 280/60).

Applications are invited for the position of Shift Charge Engineer at Burton-on-Trent Power Station, Wetmore Road, Burton-on-Trent, Staffs.

Sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Salary will be in accordance with Class E, Grade 7 (£965 - £1,090 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 13th January, 1961.

PLANT SHIFT CONTROL ENGINEER, DRAKELOW "A" POWER STATION
(Vacancy No. 281/60).

Applications are invited for the position of Plant Shift Control Engineer at Drakelow "A" Power Station, near Burton-on-Trent, Staffs.

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience. Technical qualifications to Higher National standard desirable.

Salary will be in accordance with Class J, Grade 10 (£1,040 - £1,165 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 13th January, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE5/ACT, which may be obtained from the Station Superintendent concerned and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.

7224

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

Appointment of Fourth Assistant Engineer, Telecommunications (Testing Station, Watson Street, Motherwell)

APPLICATIONS are invited from suitably qualified engineers having experience in the installation and maintenance of automatic telephone exchanges and allied equipment, and installation, repair and maintenance of mobile V.H.F. radio installations.

The salary and conditions of service relative to this appointment will be in accordance with the National Joint Board Agreement. The present classification, grading and salary will be L.13, salary scale 7, £965/£1,090 per annum. The successful candidate will require to reside within a reasonable distance of the Testing Station, Watson Street, Motherwell.

Application forms, which may be had from the undersigned, should be returned to this office within 14 days of this notice.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton.

7251

ELECTRICAL ENGINEERS

with degree or equivalent qualifications and experience of machines, switchgear and protection design and application required for work in connection with nuclear and conventional generating stations.

Please apply stating full details of experience and salary required, to:

KENNEDY & DONKIN
Consulting Engineers
64, Royal Exchange, Manchester, 2

7241

Do you want to be a

SALES ENGINEER

for Electrical Plant?

JOHNSON & PHILLIPS Ltd. have vacancies for trainee sales engineers and invite applications from ambitious young men with H.N.C. in Electrical Engineering. Vacancies exist at various branches in Britain and successful applicants will in due course handle the selling of capacitors, switchgear and transformers.

J. & P. are one of the leading companies in the industry with factories and selling organisations in this country and throughout the Commonwealth.

Applications giving details of training, etc., should be addressed to the

Employment Manager
JOHNSON & PHILLIPS LTD.
Charlton, London, S.E.7

7182

SOUTH WALES ELECTRICITY BOARD

PRINCIPAL ASSISTANT

APPLICATIONS are invited for the position of PRINCIPAL ASSISTANT to the Area Secretary, Cardiff and East Central Area.

The Board are seeking a person able to adapt himself to a variety of tasks calling for administrative ability and experience. Much of the work concerns personnel and a knowledge in this field though not essential, would be an advantage.

Salary N.J.C. Grade 7 (£1,250/£1,355 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, Assoc.I.E.E., Manager, Cardiff and East Central Area, 445/447, Cowbridge Road East, Cardiff, to arrive not later than 21st January, 1961.

Envelopes should be endorsed "Principal Assistant, 224/60."

R. G. WILLIAMS,
Secretary.

7229

ARTHUR GUINNESS, SON & CO. (DUBLIN) LTD.

St. James's Gate Brewery
Dublin

have a vacancy for an ELECTRICAL ENGINEER with Higher National Certificate or degree in Electrical Engineering. Graduate or Corporate Member of the I.E.E. preferred. Age 26-32 years, with sound experience of distribution, installation and maintenance of electrical plant and of electronics as applied to process industries.

Appointment at first temporary, probably for at least one year; could lead to a permanency and the benefits of a non-contributory pension scheme. Good health essential.

Commencing salary between £880 and £1,220 commensurate with qualifications and experience.

Financial assistance in moving home.

Apply in writing to the Chief Engineer giving full particulars of age, education, qualifications, experience and positions held, in chronological order.

Travelling expenses allowed to those selected for interview.

7239

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

GENERAL ASSISTANT ENGINEER
(Meters, Testing and Protection).

Applicants should have had a good all-round training in electrical engineering. Possession of the Higher National Certificate in Electrical Engineering is desirable.

Salary N.J.B. Class N, Grade 16 (Scale 6), £890/£1,015 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 13th January, 1961.

No. 7 (Grimsby) Sub-Area

ENGINEERING DRAUGHTSMAN.

Applications are invited for the post of Draughtsman (either Electrical or Building and Civil Engineering) in the Sub-Area Drawing Office. The successful applicant will be required to assist in the drawing office on work which includes building drawings, electrical diagrams and records.

Salary N.J.B. either Class K, Grade 16 (Scale 3), £715/£805 per annum, or Class K, Grade 15 (Scale 4), £765/£870 per annum, according to qualifications.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 13th January, 1961. 7231

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

DEPUTY POWER STATION SUPERINTENDENT is required at Worcester Power Station. N.J.B. service conditions, superannuable appointment, salary in accordance with Schedule A, Grade E3, £1,275-£1,410 per annum.

Candidates should have a wide experience in the operation and maintenance of a large modern power station and should have sound administrative ability. The possession of suitable technical qualifications will be an advantage.

Apply quoting Vacancy No. 341/60MD on form AE6, available from the Station Superintendent, Worcester Power Station, Hylton Road, Worcester, by 13th January, 1961. 7221

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

CONSUMERS' ENGINEER required in the Southport District. Salary within range £965/£1,090 per annum (N.J.B. F/8).

Duties include estimating and preparation of specifications for contracting work, and advising consumers on electrical matters and utilisation of electricity. Technical qualifications desirable.

Appointment subject to medical examination. Pension scheme.

Special application forms, obtainable from the Manager, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3, should be returned not later than 20th January, 1961. 7226

TECHNICAL SALES ENGINEER

required by old-established manufacturer of Rotary Electrical Equipment.

The candidate should have considerable knowledge of electric motors and generators and their application, and should preferably hold the Higher National Certificate or equivalent qualification.

This is a senior appointment which will admit to the company's monthly staff pension scheme.

Please write, giving full particulars, to:

Sales Director
SMALL ELECTRIC MOTORS LTD.
Churchfields Road, Beckenham, Kent

7249

ASSISTANT CONTROLLER

OF POSTS AND TELEGRAPHS SARAWAK

QUALIFICATIONS: Candidates (not over 45) must be A.M.I.E.E. or Grad. I.E.E. or possess a degree or diploma conferring exemptions from the Institution's examinations, and must have had at least 5 years' practical experience with a large telecommunications organisation.

Duties: The installation and maintenance of all types of telecommunication equipment, including 12, 5 and single-channel V.H.F. and H.F. radio networks and small automatic exchanges.

Terms: On contract for one tour of 3 years with salary at appropriate point in the scale £1,386-£2,324. Gratuity payable. Free passages, child education and outfit allowances. Generous leave.

Write to Director of Recruitment, Colonial Office, London, S.W.1, giving full names, age, qualifications and experience, quoting BCD.108/24/01/D11.

7173

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Thames South Control Centre, East Grinstead

Fourth Assistant Engineer
(Vacancy No. 60B/60)

APPLICATIONS are invited for this appointment to assist in the department's planning works and possibly to undertake occasional shift duties in the control room. Experience of system operation, power station or transmission practice and technical training to at least O.N.C. level are required.

Salary on N.J.B. BX.11, £855 to £1,165 per annum, with prospect of promotion to BX.10 (maximum £1,245) and BX.9 (maximum £1,325) when suitably experienced. Shift allowance is payable when applicable.

Applications giving age, details of experience, present position, etc., and quoting Vacancy No. should be sent to the Personnel Officer, Central Electricity House, Lower Ham Road, Kingston-upon-Thames, Surrey, to arrive by 18th January, 1961.

W. H. DUNKLEY,
Divisional Controller.

7218

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

ASSISTANT ENGINEER (Operation and Efficiency) required at Hinkley Point Nuclear Power Station.

Superannuation scheme. Salary N.J.B. Class O, Grade 8, Scale 15, £1,650-£1,830 per annum.

Applications are invited for the position of Assistant Engineer (Operation and Efficiency) at Hinkley Point Nuclear Power Station.

The successful candidate will be responsible for assessing the technical performance of all plant and will be especially concerned with carrying out heat balances, efficiency trials, fuel handling and movement planning and generally assisting the operation superintendent in all aspects of station operation. He should have had experience in a conventional station but nuclear experience is not necessary, as suitable training will be given. Qualifications leading to Corporate Membership of a Senior Engineering Institution or a University degree are desirable.

Applications on Form A.E.6/ACT obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 11th January, 1961, quoting Vacancy No. ER/AV/179/60. 7219

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION

Vacancy—Assistant Engineer (Standards and Development)

THE TRINIDAD AND TOBAGO ELECTRICITY COMMISSION has a vacancy for an ASSISTANT ENGINEER (Standards and Development) in its Distribution Division at Head Office.

Applicants must hold a degree or the Higher National Certificate in Electrical Engineering or be Graduate Members of the Institution of Electrical Engineers.

The annual salary is £1,470 rising to £1,590 in accordance with Grade 6D of the Commission's salary schedule. A car allowance is also paid for necessary journeys undertaken on Commission's business.

The successful applicant will be responsible to the design engineer mainly for the preparation of standards and methods of construction and of materials used in the distribution division and also for the preparation of specifications and checking of tenders in connection with orders for distribution material and equipment.

An outfit allowance of £60 is also paid on arrival in Trinidad.

A partly furnished house will be provided at a rent of £10 8s. 4d. per month, plus a small extra charge for heavy furniture.

First class passages to Trinidad will be provided for the successful applicant, his wife and children up to a maximum cost of four adult passages. First class leave passages to the United Kingdom will be provided every three years.

Information on Trinidad can be obtained from the West India Committee, 40, Norfolk Street, London, W.C.2.

There is a superannuation scheme similar to the C.E.G.B. and Area Board's scheme.

Applications giving full details of qualifications, age, experience, etc., together with copies of two recent testimonials should be sent by Air Mail to reach the General Manager, Trinidad and Tobago Electricity Commission, P.O. Box 121, Port-of-Spain, Trinidad, West Indies, by 15th February, 1961. 7238

POST OFFICE: ASSISTANT ENGINEER

ABOUT 20 permanent and pensionable posts for men at least 17½ and under 23½ on 1.3.61, with extension for Forces service, Overseas Civil Service, and, up to two years, for permanent civil service. Written examination, beginning 5.4.61, in English, Physics and two prescribed optional subjects, followed by interview of qualified candidates.

Salary (London) £560 at 18, 19 or 20, £620 at 21, £785 at 25 or over, rising to £1,205. Five-day week in general. Promotion prospects.

Write Civil Service Commission, Burlington Gardens, London, W.1, for application form, quoting 159/61. Closing date, 26th January, 1961. 7205

J. & P.

require a

SALES ENGINEER IN EXETER

Johnson & Phillips Ltd. require an experienced man to handle the sales of electrical plant in Devon and Cornwall areas and to take charge of a cable depot in Exeter. This is an interesting and progressive post in an exceedingly pleasant territory which is expanding industrially.

Please send details of experience and salary required to the Employment Manager, Johnson & Phillips Ltd., Charlton, London, S.E.7.

7211

ELECTRICAL AND MECHANICAL ENGINEER

GOVERNMENT OF ADEN

PUBLIC WORKS DEPARTMENT

QUALIFICATIONS: Candidates must be A.M.I.Mech.E. or A.M.I.E.E., with 10 years' extensive experience in electrical and mechanical engineering.

Duties: To take charge of the electrical and mechanical branches of the department and to advise the Director of Public Works on technical matters in those spheres.

Terms of appointment: Contract for 18-24 months. Salary at appropriate point in scale £1,232 - £2,004. Gratuity. Children's allowances. Free passages. Outfit allowance. Married quarters available at moderate rental. Generous home leave.

Write Director of Recruitment, Colonial Office, London, S.W.1, giving full names, age, qualifications and experience, quoting BCD.112/2/018/D11.

7193

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. Schedule A appointments of STATION SHIFT CONTROL ENGINEERS.

CARMARTHEN BAY POWER STATION, BURRY PORT, CARMS. (Vacancy No. 334/ER/60).

Salary Class K, Grade 10, Scale 9, £1,115 to £1.245 per annum, plus 10% shift enhancement.

UPPER BOAT POWER STATION, Nr. PONTYPRIDD, GLAM. (Vacancy No. 335/ER/60).

Salary Class H, Grade 10, Scale 7, £965 to £1,090 per annum, plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications, and have had operating experience in a modern power station.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 21st January, 1961. 7217

SALES MANAGER

required by Electrical Division of nationally known company located in East Anglia to organise and develop the sales department in the fields of electrical contracting, refrigeration and retail sales.

This is a new appointment and the successful applicant, preferably under 40, will have sales experience in dealing with customers at senior executive and director level.

A four-figure salary according to qualifications and experience plus commission is envisaged. Car provided. Pension fund.

Apply in confidence stating age, qualifications and present salary to the Electrical Director.—Box 7175.

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SERVICE CENTRE ASSISTANT required at Johnstown, near Wrexham. Salary within the range £223/£640 per annum, according to age, experience and educational qualifications.

Applicants should preferably have had experience in the electrical retail trade, or similar sales experience.

Appointment subject to medical examination. Pension scheme.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Rhostyllen, near Wrexham, or from any District Office.

Closing date, 11th January, 1961. 7198

Situations Vacant (continued)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER required at Towyn, in the Aberystwyth District. Salary within range £715/£805 per annum (N.J.B. E/11).

Applicants should have completed a recognised electrical apprenticeship and had some technical training. Duties will include estimating, preparation of specifications and supervision of contracting work, advising consumers on matters relating to electricity supply and the utilisation of electricity. The ability to speak Welsh and to drive would be an advantage.

The work is of an interesting nature, and the post is pensionable, with good working conditions and reasonable future prospects to suitable staff.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, nr. Wrexham. Closing date, 13th January, 1961.

Applications in response to previous advertisement remain under consideration. 7197

BRITISH STANDARDS INSTITUTION

Technical Staff

THE B.S.I. invites applications from ELECTRICAL ENGINEERS to join the staff of the Institution. This staff is responsible for the work of the Institution in the preparation of British Standards in co-operation with the various sections of industry and is required to plan and progress the work. They act as secretaries to technical committees.

Applicants should have a university degree or an equivalent professional qualification in electrical engineering.

There are three grades of appointment and salaries in the top grade range up to £2,000 plus; applications are invited for the grade which has at present a maximum salary of £1,350, the starting salary being dependent on individual qualifications and experience. The posts are pensionable.

Apply to the Establishment Officer, B.S.I., 2, Park Street, London, W.1. 7242

NORTH EASTERN ELECTRICITY BOARD

York Sub-Area

APPLICATIONS are invited for the appointment of a THIRD ASSISTANT ENGINEER, Sub-Area Commercial Officer's Staff, with location at Sub-Area Headquarters, York.

Salary Schedule A, Class H, Grade 10, £965/£1,090 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement. 7237

AGENT required for the London area by a firm engaged in the manufacture of domestic electrical appliances; must have live connection amongst all wholesalers in London and the Home Counties. Apply in strictest confidence giving full details to—Box 7208.

AN experienced outside sales representative of good education and with a sound electrical background is required by Crompton Parkinson Limited to sell their Induction Motors on his own initiative in the Hull area. This is a staff appointment, carrying a good salary and pension benefits. Please apply for application form to MA/P2, Crompton House, Aldwych, London, W.C.2. 7127

ASSISTANT electrical engineer required for London office of large multiple retail store, to assist in the preparation of drawings and specifications of electrical installations, etc. Applicants should have served an electrical apprenticeship and preferably attained City and Guilds Course C standard or equivalent, and must be a capable draughtsman. Age 24/26 years. Salary £650-£800 per annum according to age and experience. Write giving full particuars to — Surveyor's Department, P.O. Box 209, North Row, Marble Arch, London, W.1. 7170

CABLE ganger for country work; good rates of pay and conditions. Apply—16, Stratford Place, London, W.1 (Tel. MAY. 6411). 7189

ASSISTANT to director required; preferably 25 to 30, well-educated, with adaptable mind and ability to write lucid reports; knowledge of electrical industry, book-keeping or trade association work advantageous; interesting and varied work as committee secretary, bookkeeper, helping in market and export research, statistics, etc. Starting salary about £750-£850. Full particulars to—Director, Electric Light Fittings Association, 89, Kingsway, London, W.C.2. 7212

CABLE jointers and mates required. Preferably residing in Hampshire.—Box 7699.

CONTRACTORS require man conversant with power station cabling for North of England. Apply—16, Stratford Place, London, W.1 (Tel. MAY. 6411). 7190

DEVELOPMENT electrical engineer for a series of projects, the first of which is concerned with a special purpose transformer. Theoretical knowledge required to O.N.C. Electrical, or equivalent standard. Development, test or laboratory experience an advantage. Some knowledge of production techniques would also be useful. An interesting opportunity for a young man to enter this type of work.—The M.E.I. Co. Ltd., Upper Villiers Street, Wolverhampton. 7243

ELECTRICAL breakdown man required in January. Minimum rate 6s. 6½d. per hour plus 4-room flat accommodation in North London.—Box 188.

ELECTRICAL draughtsman. Young man required by elec. contractors (Westminster) with some experience of preparing electrical installation schemes. Write age, experience and salary.—Box 7244.

ELECTRICAL wholesalers have vacancies for experienced trade counter staff. North London area. — Phone, STAmford Hill 3395 (Mr. Gayler). 7188

ELECTRICIAN required for plantations company in Liberia, West Africa. Age 30/45, married/single, with at least 5 years' experience, able to supervise and if required carry out all types of electrical work, from ordinary wiring to operating hydro plant. Previous experience abroad and handling of native workmen preferable. Housing and car provided. Salary $500 per month.—Box 7145.

ESTIMATING, site supervising and design engineer required for high-class installation work of all descriptions. Permanency and good immediate prospects for keen and able engineer. Write stating age, experience and salary required to — Mr. C. King, Alliance Electrical, 2, Henrietta Street, London, W.C.2. 137

LIGHTING control gear designer, age 20-30 years, required for design of transformers and chokes for electric discharge lamps in lighting laboratory. Some knowledge of electronics and transistor experience an advantage. H.N.C. or equivalent or O.N.C. studying for H.N.C. Some industrial experience essential. Apply, quoting Ref. No. L.2008, to—Personnel Manager, Thorn Electrical Industries Ltd., Great Cambridge Road, Enfield, Middlesex. 7177

LONDON office of leading Continental manufacturers requires sales representative with engineering background to introduce and promote the sale of miniature circuit breakers, contactors and kindred equipment in the U.K. for industrial and marine applications. Connections with consultants, wholesalers and large buyers an advantage. Although based in London office the person selected would be required to travel extensively at least initially. Good experience, flair for business, initiative and personality are expected; knowledge of German preferred but not essential. Post with generous salary and commission and pension scheme. Applicants should give details of age, education, career to date, etc.—Box 7245.

M.K. ELECTRIC Ltd. invite applications for position of area sales representative for East Anglia covering the counties of Norfolk, Suffolk, Cambridge and part Essex. Applicants must have good education and preferably a thorough knowledge of the marketing and distribution of electrical accessories. Applications, giving full particulars of past experience, age and salary required, will be treated in strict confidence if addressed to the Sales Manager, M.K. Electric Ltd., Shrubbery Road, Edmonton, London, N.9. 7142

NEW Delhi paper power cable manufacturers require first-class cable engineer, also test engineer. For further details telephone London WATerloo 2248. 7199

LUMENATED CEILINGS Ltd. urgently require an experienced representative to call upon architects, consultants and users in important London area. Knowledge of lighting desirable. A car will be provided and the post is permanent and pensionable, and offers good prospects. Remuneration will be by way of a good salary and commission. Apply in strict confidence—Sales Manager, Alliance House, 12, Caxton Street, London, S.W.1. 7191

PHILIPS ELECTRICAL Limited, due to expansion of sales force, require a representative to sell lamp and lighting equipment to wholesalers, contractors and users in Berkshire and part of Surrey/Hampshire. The successful applicant will be required to reside in the territory and must be aged 30/35 years. A selling record in the electrical industry is preferable but not essential, for the chief qualities required are drive, initiative and good educational background. A good salary is offered, car provided, position is progressive and pensionable. Write in strictest confidence to the Personnel Officer, Century House, Shaftesbury Avenue, London, W.C.2, quoting ref. BVM554. 7207

REPRESENTATIVE required by leading electrical distributors for London West End, W.C.1 and North London areas. Applications can only be considered from men who have an intimate knowledge of electrical wholesaling and a proven sales record. Excellent prospects, non-contributory pension and life assurance. State age and full details of past and present employment.—Staff Manager, The Wholesale Fittings Co. Ltd., 46, 50-54, Commercial Street, London, E.1. 7209

SALES engineer required by British-owned company in Nigeria with important electrical and mechanical engineering agencies. Experience of quoting for as well as selling technical engineering products an advantage. Successful applicant will be based in Lagos but must be willing to do some travelling within Nigeria. Salary £1,500 per annum with free accommodation, electricity, transport, passages, etc. Write stating full experience to—Box No. B.W. c/o J. W. Vickers & Co. Ltd., 7, Great Winchester Street, London, E.C.2. 7178

SUPERVISING engineer required, preferably about 30, experienced in preparation of estimates and specifications for lighting, heating and water heating schemes. Able to advise clients and supervise works. Applicants must have a thorough knowledge of contracting with particular reference to domestic and commercial installations. Vehicle provided. Expanding company, Kensington (London) area. Give age, details of experience and salary required to—Box 7246.

WELL-known pump manufacturers in the Midlands area require an electrical engineer who will be responsible for the design of submersible type induction motors from fractional to medium horse-power sizes and also automatic control schemes for pumping equipment. Applicants should preferably have had previous knowledge of submersible motor design but persons with considerable experience of industrial type motors would be considered. Automatic control gear experience is essential. Qualifications required are a Degree or Higher National Certificate in Electrical Engineering, together with Corporate or Graduate Membership of the Institution of Electrical Engineers. The starting salary will be according to age, qualifications and experience. Apply—Box 7179.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

SYNCH. machine designer, wide exp. 400-cyc. and specials, req. project/design.—Box 7698

ARTICLES FOR SALE

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

600

VARIABLE SPEED DRIVES COMPLETE SUITABLE FOR PRINTING PRESS OR SIMILAR APPLICATION

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VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

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ELECTRICAL REVIEW

SPIN AND TUMBLER DRYERS

6 JANUARY 1961

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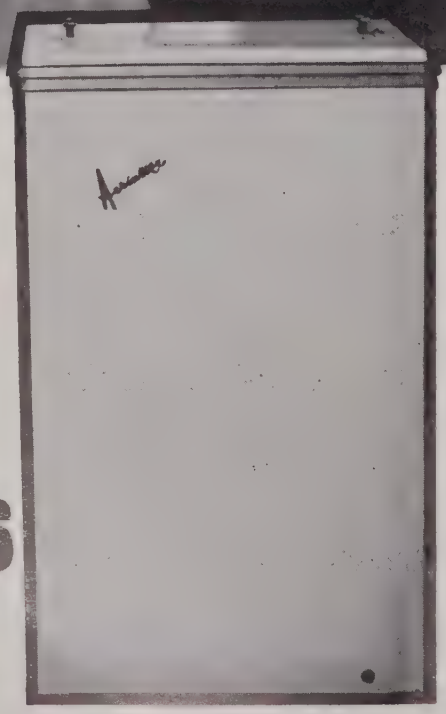
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SPIN AND TUMBLER DRYERS

Although the sales of electrical spin dryers during the first six months of 1960 were down compared with the corresponding period for the previous year recent sales figures indicate that the position has now improved and sales prospects are once again reasonably good. Several factors no doubt accounted for the fall in demand for these most useful items of home laundry equipment, not the least of which was the re-introduction of hire purchase restrictions and the increase in the number of combined washer/spin dryers. To offset this many of the leading manufacturers have substantially reduced the price of their machines, and these reductions, coupled with the wettest autumn on record, have no doubt done much to stimulate sales.

Since the last time we reviewed spin dryers several more firms have entered the market but a number of makers have dropped out. Included among the latter are Chilton Electric Products, Ltd., manufacturers of the "Chilton" spin dryer, claimed to be the first machine to be made and marketed in Great Britain. This model was withdrawn from production at the end of 1960. The Simplex Electric Co., Ltd., have, however, demonstrated their confidence in the future of spin dryers by introducing a de-luxe version of their "Creda Debonair" with automatic emptying pump and rinsing facilities. The original "Creda Debonair" spin dryer, restyled the "Debonair Popular," will continue to be sold as long as existing stocks last.

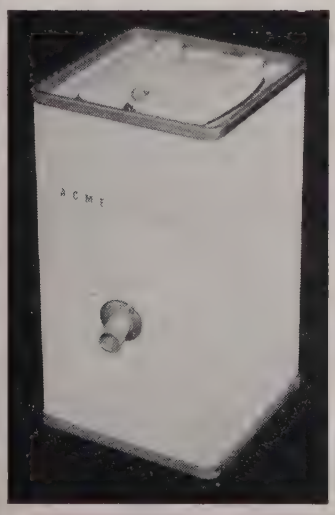
Despite its name, the spin dryer's function is not to dry clothes but to produce a sufficiently damp-dry load of washing, ready for ironing, within a short space of time. The operation takes approximately four minutes and even if the time is extended it will in no way further dry the clothes. An exception may however be found in the "Thermair" machine which has a 750 W heater contained in the lid.

Manufacturers of heated tumbler dryers claim not only to dry the clothes but, in some cases, to get a wash aired ready for instant use. They differ from the spin dryer inasmuch as air is drawn through a heating element by a fan and circulated through the clothes in a drum revolving at a much lower speed; approximately 45/50 r.p.m. compared with 2,000 r.p.m. and upwards for the spin dryer.

Details of combined washing machines/spin dryers and self-contained washing machines will be featured in our next supplement to be published on 17th February.

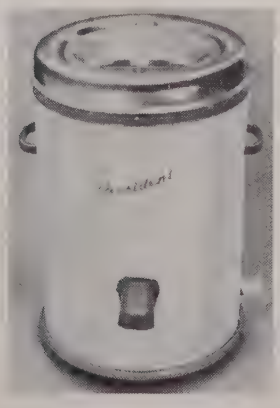
SPIN DRYERS

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
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	"Acme" De-Luxe	32¾ · 14⅝ · 16	6 lb	2,400 r.p.m.	White or cream	Automatic pump and rinsing	£29 0 0	£5 6 0
AERIALITE, LTD., Hargreaves Works, Congleton, Cheshire.	"Aerialite Rota-Rinse"	27½ × 15 × 15	6 lb	2,350 r.p.m.	White with blue trim	Automatic pump and rinsing	£28 9 4	£5 2 8



1

1. *Acme standard model with spout*
2. *Bylock "President" spin dryer with transparent lid*
3. *Aerialite "Rota-Rinse" automatic pump model*



2



3

DRIERS ARE NOT ALIKE

THIS YEAR— SELL THE DRIER WITH 6 BIG ADVANTAGES



When used in conjunction with the Liberator washing machine the Tumble Dry forms a complete home laundry unit. To save floor space the Tumble Dry can be fitted on top of the Liberator washing machine.

AND THERE'S A BONUS ADVANTAGE TO DEALERS THIS YEAR—

Whole-page advertising in the Sunday Express, and big-space advertising in the influential Sunday newspapers.

'ENGLISH ELECTRIC'

LIBERATOR

TUMBLE-DRY

1 Gentle tumbling action eliminates unnecessar wear and creasing, makes ironing easier.

2 The Tumble Dry is especially suitable for drip-dry and crease-resistant fabrics.

3 Exclusive 5-minute cooling-off period minimize creasing.

4 Set the dial and the Tumble Dry does the rest; i switches itself off automatically.

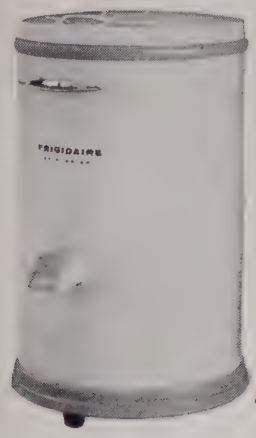
5 Choose either damp-dry for ironing, or bone-dr and aired for putting away or wearing.

6 Big drum takes curtains, chair covers, even double blankets.

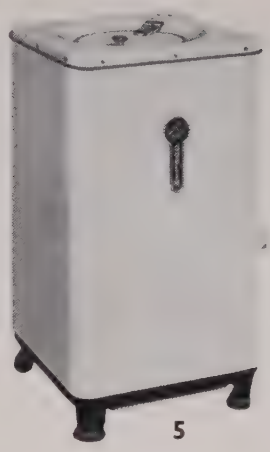
'ENGLISH ELECTRIC'

THE ENGLISH ELECTRIC COMPANY LIMITED, DOMESTIC APPLIANCES DIVISION, EAST LANCASHIRE ROAD, LIVERPOOL, 1

SPIN DRYERS *[continued*



4


5

4. *Frigidaire model A-1000 spin dryer*
5. *Goblin (B.V.C.) "Spin-Quick" spin dryer*
6. *Easiclene model SD.1 large capacity dryer with foot pedal control*


6

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
BYLOCK ELECTRIC, LTD., South Street, Ponders End, Middlesex.	"President" Z.3	22×14 diameter	6/7 lb	2,800 r.p.m.	White with blue trim, chromium rim	Transparent lid	£24 3 4	£4 8 4
	"President" Z.36	22×15×16	6/7 lb	2,800 r.p.m.	White with blue trim	White lid	£25 10 0	£4 13 3
DENHAM & MORLEY, LTD., 173, Cleveland Street, London, W.1.	"Scharpf Rotarinse" Mk. II	24½×15×17⅜	8½ lb	2,200 r.p.m.	White vitreous enamel	Automatic pump, deep-flow rinsing	£30 0 0	£5 10 0
	"Scharpf Rotadry" Mk. IV	25×10½×17	9 lb	2,200 r.p.m.	White vitreous enamel, chromium rim and lid	—	£19 19 6	£3 13 0
	"Scharpf Rotadry" Mk. II	20×9×14	4½ lb	2,200 r.p.m.	White vitreous enamel, chromium rim	Transparent lid	£14 3 0	£2 13 0
EASICLENE PORCELAIN-ENAMEL (1938), LTD., Lord Street, Wolverhampton.	"Easiclene" SD1	28×16½×16½	7 lb	1,425 r.p.m.	White or cream stoved enamel	Large capacity, foot pedal control	£20 8 4	£3 14 8
	"Easiclene" "Spinette" SD2	23½×16½ diameter	4½ lb	1,425 r.p.m.	White or cream stoved enamel	Polished aluminium inner lid	£17 15 1	£3 4 11
EDY, 55, Park Lane, London, W.1.	"Edy" Minor	20×14 diameter	6 lb	1,500 r.p.m.	White vitreous enamel	Rubber suction feet	£17 12 5	£3 6 0
	"Edy" Automatic	26⅜×14⅜ diameter	8 lb	1,500 r.p.m.	White vitreous enamel	Transparent lid, automatic brake when lid opened	£22 0 9	£4 2 8
ELECTRO APPLIANCES & EQUIPMENT, LTD., Mitre House, 177, Regent Street, London, W.1.	Sigma "Diana"	24×15 diameter (approx.)	6½ lb	2,800 r.p.m.	White stoved enamel	Automatic brake	£22 5 3	£4 3 7
	Sigma "Cresta"	26×15 diameter (approx.)	8½ lb	2,800 r.p.m.	White stoved enamel	Automatic brake	£29 5 4	£5 9 10
	Sigma "Vanessa"	26×15 diameter (approx.)	8½ lb	2,800 r.p.m.	White stoved enamel	De-luxe model, automatic brake and automatic pump	£36 13 7	£6 17 8

SPIN DRYERS *[continued*

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
FRIGIDAIRE DIVISION OF GENERAL MOTORS, LTD., Stag Lane, Kingsbury, N.W.9.	A-1000	25×15×17	6 lb	2,800 r.p.m.	White or cream stoved enamel, grey trim	Automatic cut-out device	£20 8 4	£3 14 8
GOBLIN (B.V.C.), LTD., Goblin Works, Leatherhead, Surrey.	"Spin-Quick"	27¾×16×16	6 lb	2,800 r.p.m.	White stoved enamel	Quietness in operation	£25 14 10	£4 14 2
GRAMOPHONE CO., LTD., Hayes, Middlesex.	"H.M.V." DSD1	22×16½ diameter	7 lb	2,800 r.p.m.	White stoved enamel, chromium top	Transparent lid, rubber suction feet	£23 19 4	£4 7 8
HOOVER, LTD., Perivale, Greenford, Middlesex.	"Spinarinse" 3004	30⅝×13¾×16⅝	6 lb	2,400 r.p.m.	White stoved enamel, blue aluminium lid	Rinses as well as spins, pump emptied	£30 0 0	£5 12 6
LONOR, LTD., 1, Maddox Street, London, W.1.	"Siemens" WS5	30×17 diameter	9 lb	1,600 and 2,000 r.p.m.	Rust-proof white enamel	Large capacity, two-speed drum	£33 17 5	£6 2 4
	"Cleanmaster"	21×14 diameter	6 lb	1,450 r.p.m.	White enamel	Hand brake and automatic on/off switch	£16 18 0	£3 1 0

The washing machine you've been waiting for...

BYLOCK PRESIDENT



COMBINATION WASHING MACHINE

* WASHES * BOILS

* RINSES * SPINDRIES

Just look at all these features:

1. WASH
5 lb. load—"pulsator-boil" action—full boil if required—safe and gentle

2. HEATER
2 kW—fitted automatic self-resetting thermal cut-out

3. AUTOMATIC TIMER
No overwash—graduated 1 to 4 minutes

4. CONTINUOUS FLOW ROSE-RINSING
Leaves clothes sparkling fresh and soft. Water returned to wash tub for second wash if required

5. HIGH-SPEED SPIN DRYING
No wringing—no crushed buttons—safe for finest fabrics. Clothes damp dry in 2-4 minutes. Safety switch in lid

6. TWIN MOTOR AND PUMPS
Enabling washer and spinner to be operated independently or together

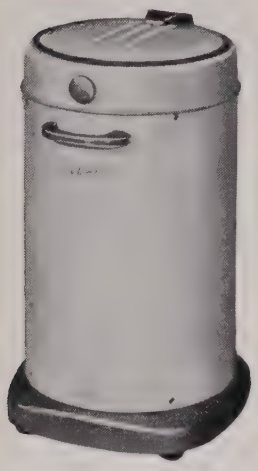
7. CASTOR MOUNTED
For easy movement

And yet the price is only 60 gns. TAX PAID

Laminated Plastic Table Top (Optional) £3 Tax Paid GUARANTEED FOR 2 YEARS

For full information write to: BYLOCK ELECTRIC LIMITED · ENFIELD · MIDDLESEX

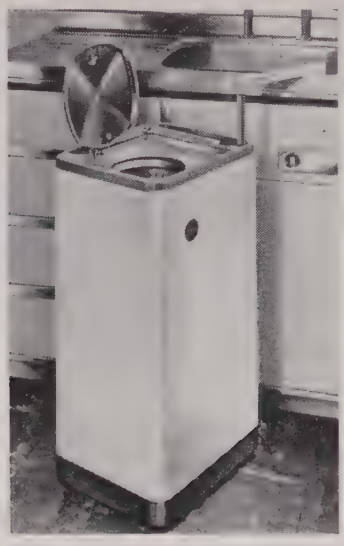
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7. *R. & A. Main "Mainspin" spin dryer*
8. *Morphy-Richards "Astral" spin dryer*
9. *Hoover "Spinarinse" dryer rinses as well as spins*
10. *Philips spin dryer*
11. *Gramophone Co.'s "H.M.V." model DSD1 spin dryer with transparent lid*
12. *Siemens model WS.5 large capacity spin dryer with two-speed drum (Lonor, Ltd.)*

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
R. & A. MAIN, LTD. (Electrical Division), 48, Grosvenor Gardens, London, S.W.1.	"Mainspin"	27½ × 16 × 18	6/7 lb	2,400 r.p.m.	White stoved enamel with blue or grey fittings, or cream with green	Automatic switch and brake	£18 10 0	£3 7 8
MARTIME, LTD., City House, Morley Street, Bradford.	"Lancastrian"	36½ × 18 × 19	6/8 lb	2,800 r.p.m.	White stoved enamel, red trim	Transparent lid, starter handle locks lid	£20 0 0	£3 15 0
MORPHY-RICHARDS (ASTRAL), LTD., 50, Conduit Street, London, W.1.	"Astral"	24½ × 15½ × 18⅜	7/8 lb	2,200 r.p.m.	White or cream stoved enamel	Safety interlock, lid controls motor, foot brake, castors	£19 11 5	£3 10 7
PARKINSON COWAN APPLIANCES, LTD., Stechford, Birmingham, 33.	"Pirouette"	25 × 15¾ × 19⅝	6/8 lb	2,700 r.p.m.	White with blue or cream with red stoved enamel	Treaded rubber wheels and rubber feet	£19 11 4	£3 10 8

SPIN DRYERS *[continued*

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
PHILIPS ELECTRICAL, LTD., Shaftesbury Avenue, London, W.C.2.	"Philips" HA.2000	25½ × 15½ × 15½	5/6 lb	2,800 r.p.m.	White and mist grey stoved enamel with red trim and chromium fittings	Rapid acceleration and braking	£22 3 10	£4 1 2
SELIG DOMESTIC APPLIANCES, LTD., 35, Stoke Newington Church Street, London, N.16.	"Auto-Rinse"	28 × 17½ × 14¾	6/8 lb	2,800 r.p.m.	White with grey trim	Automatic rinsing and pump emptying	£33 2 3	£4 13 9
SIMPLEX ELECTRIC CO., LTD., Creda Works, Blythe Bridge, Staffs	Creda "Debonair de-Luxe"	27½ × 16⅞ × 16½	6 lb	2,800 r.p.m.	White or cream stoved enamel, Polystyrene lid and top	Automatic emptying pump. Rinsing facilities. Safety locking lid controlling motor and brakes. Four wheels for easy mobility. Extra fast braking	£26 3 9	£4 15 9
W. & S. SUMMERSCALES, LTD., Parkside Works, Keighley, Yorks.	"Scales" SD4	27½ × 15¾ × 15¾	6/7 lb	1,450 r.p.m.	White Stelvetite	Direct motor drive to spinner, quietness in operation	£27 10 4	£5 0 8
THERMAIR DOMESTIC APPLIANCES, LTD., Tame Road, Witton, Birmingham, 6.	"Thermair"	26 × 15 diameter	6/7 lb	1,425 r.p.m.	White and cream stoved enamel	Lid fitted with 750 W heater, gyroscopic stabiliser	£31 8 7	£6 17 11

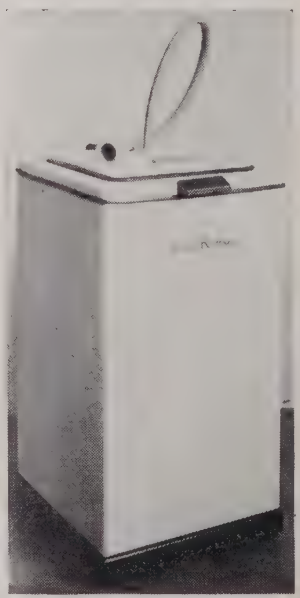
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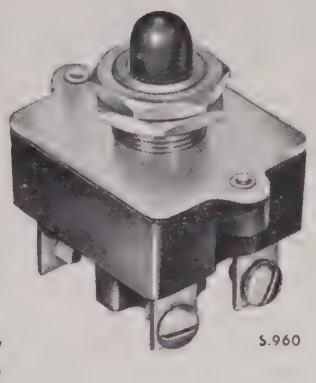


13. *Wilkins & Mitchell Servis "Rinspin" with "Deep Rinse" water extraction*
14. *Simplex "Creda Debonair" de-luxe spin dryer with automatic pump and rinsing*
15. *Selig Domestic Appliances "Auto-Rinse" with automatic rinsing facilities*
16. *Parkinson Cowan "Pirouette" spin dryer*
17. *Thermair heated spin dryer*

Arcolectric

Switches

Neon Signal Lamps



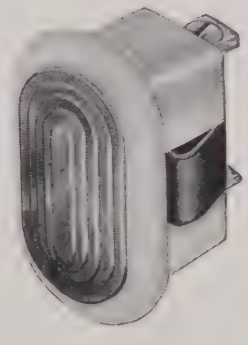
S.960

S.L.160, S.L.162 and S.L.163

New miniature low cost Neon Signal lamps.
½" hole fixing. All completely waterproof.
The S.L.163 has small front of panel projection.



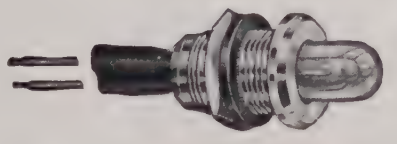
S.L.160



S.L.50

C.S.200: 15-AMP Rotary Cooker Switch.
Double Pole three "heat" and "off".

S.L.50: Neon Signal Lamp with snap-in fixing.



S.L.162

M.30: 10-AMP Toggle Switch.

S.L.190: New Snap-in fixing Neon Signal Lamp.

S.254: AC only 10-AMP Toggle Switch, double pole.

S.250: A single pole version of the S.254.

S.960: New Spin Drier Switch, double pole.

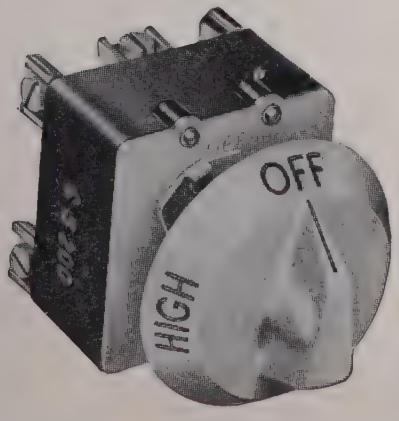


S.L.190

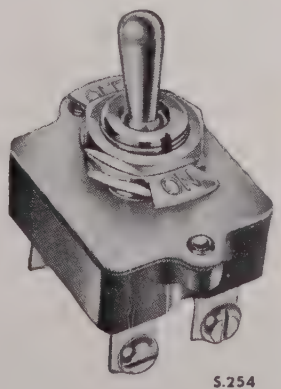
Write for Catalogue No. 132

Arcolectric Switches Ltd.

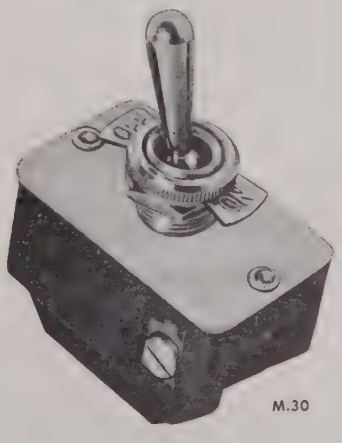
Central Avenue - West Molesey - Surrey - Tel: Molesey 3232



C.S.200



S.254



M.30

SPIN DRYERS *[continued*

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
VACMASTER, LTD., 67, Victoria Street, Liverpool, 1.	"Vorwerk"	21½×14 diameter	6½ lb	1,450 r.p.m.	White, turquoise handles and spout	Brake operated by drum	£24 0 7	£3 19 5
WELMEC CORPORATION, LTD., 147/8, Strand, London, W.C.2.	"A.E.G." SD.25	21½×15×16	5 lb	2,600 r.p.m.	White stoved enamel	"Rilsan" plastic finish on drum	£16 17 4	£3 1 8
WILKINS & MITCHELL, LTD., Darlaston, South Staffs.	"Rinspin"	31×17½×18	6 lb	2,200 r.p.m.	White stoved enamel, grey trim	"Deep Rinse" water extraction, 2-purpose hose	£29 17 11	£5 12 1

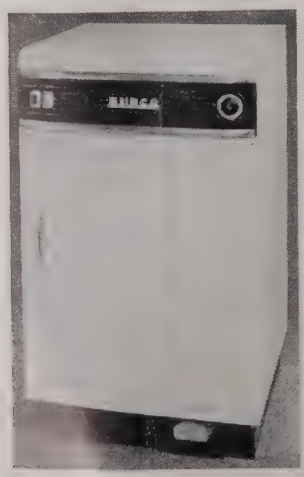
TUMBLER DRYERS

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Heater Loading and Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
ACME DOMESTIC EQUIPMENT, LTD., David Street, Glasgow, S.E.	Acme "Sun-Breeze" Large	36×24×20½	7/8 lb	Heater: 2·6 kW — 50 r.p.m.	White or cream stoved enamel	Three-heat switch, automatic timer control, ozonifier	£47 0 0	£8 11 10
	Acme "Sun-Breeze" Small	30×20½×20½	5/6 lb	2 kW — 50 r.p.m.	White or cream stoved enamel	Three-heat switch, automatic timer control, ozonifier	£42 0 0	£7 13 7
BURCO, LTD., Rose Grove, Burnley, Lancs.	"Tumblair"	36×21×20	5 lb	Heater: 1 kW (low) 2 kW (high) — 52/54 r.p.m.	White/blue or cream/blue	Adjustable heat control, thermostatic control, pilot lights. Castors 15s 1d extra	£42 0 0	£7 13 7



18

18. *Radiation Parnall "Auto-Dry" model TD.59 tumbler dryer*
19. *Burco "Tumblair" tumbler dryer*
20. *English Electric "Liberator" tumbler dryer*



19



20

DIPLOMAT'

Geoffrey Howard told the action, a claim damages and an restraining Iannucci wing certain photo-

Iannucci should pay the costs of the case.

The pictures were "all of an objectionable character."

describes him as a good husband and father," said Mr. Pickles.

From the end of 1958 Brook began to spend more and more time away from home, often for several days a week.

Money troubles

Subsequently, Mrs. Cordingley had a child by him. "Brook's dual role affected his general health," Mr. Pickles went on. "Finally he went



...e's the Ad! that makes the AUTO-DRY an AUTO-BUY!!

Reaches 88% of all housewives —in BIG SPACES— in their favourite Sunday papers:

OF THE WORLD, THE PEOPLE, SUNDAY DISPATCH, SUNDAY EXPRESS, SUNDAY PICTORIAL *plus the* RADIO TIMES.

Parnall's big dryer campaign — starting January 22nd — will bring prospects right into your showroom

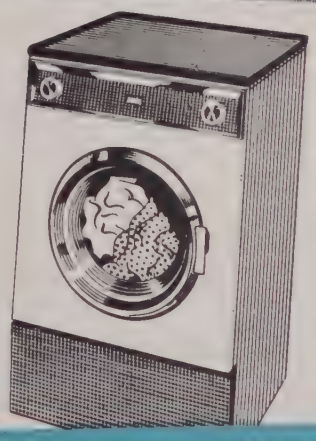
WHEN YOU CAN'T SEE YOUR KITCHEN FOR THE CLOTHES-LINE



...IT'S TIME YOU HAD A PARNALL AUTO-DRY

Away with the washing—into the Parnall Auto-dry! In a current of warm air, the whole family wash is tumbled dry, quickly, gently and so *conveniently*.

All you do is set the timer and the temperature controls; the Auto-dry does the rest—gives you a perfect drying day whatever the weather—even switches itself off when the clothes are ready.





READY TO IRON!
The Auto-dry tumbler dryer will dry the family wash just right for ironing—quickly and efficiently!



READY TO WEAR!
Save hours on drip-dry! Non-iron garments and furnishing fabrics, etc., are speed-dried and aired ready to wear!

PARNALL AUTO-DR

ELECTRIC TUMBLER DRYI

De-Luxe Model TD.59 £49.10.0. tax paid *(as illustrated)*
Tuck-away Model TD.57 £42.0.0. tax paid
Moist air extractor hose available as an optional extra

This powerful national advertising is supported by

- Co-operative advertising, with half cost paid by Parnal for approved dealers.
- Full-colour leaflets, crowners, price cards.

MORE TO TELL MORE TO SELL WITH THE PARNALL AUTO DR

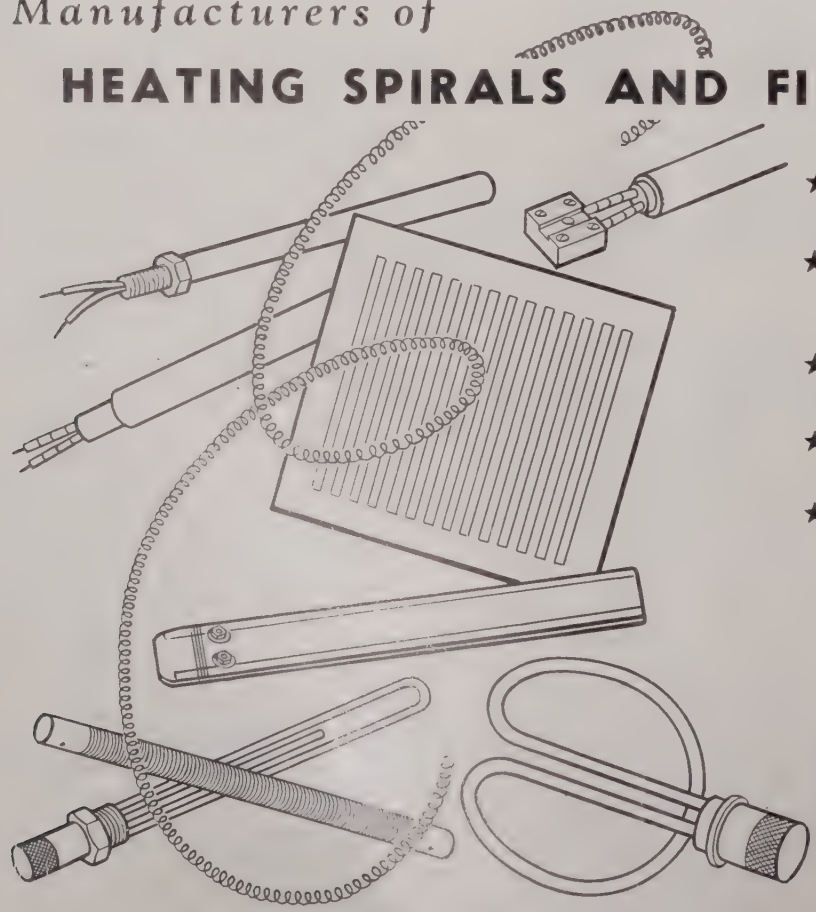
Electrical Division of Radiation Ltd., 395 North Circular Road, N.W.10

TUMBLER DRYERS *[continued*

Manufacturer or Distributor	Name or Model	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Heater Loading and Drum Speed	Exterior Finish	Special Features	Price (excl. tax)	Purchase Tax
ENGLISH ELECTRIC CO., LTD., English Electric House, Strand, London, W.C.2.	4600	36×26¼×24½	8/9 lb	Heater: 2,750 W — 48 r.p.m.	White or cream stoved enamel, aquamarine, lavender or candy pink top	Thermal cut-out, auto time control, mounted on castors	£44 7 9	£8 2 3
	"Liberator" 4602	33½×25×21	6/7 lb	Heater: 2,000 W (low) 2,750 W (high) — 55 r.p.m.	White or cream stoved enamel	Two-heat switch, automatic timer (120 min) including "cooling off" period, mounted on castors and wheels	£51 9 9	£9 8 3
RADIATION, LTD. (Electrical Division), 255, North Circular Road, Neasden, N.W.10.	Parnall "Auto-Dry" TD57	29×21⅜×20¼	6 lb	Heater: 2,500 W — 45 r.p.m.	White or cream stoved enamel, vitreous enamel top	Three-heat control, automatic timer and door cut-out switch, fits under draining board	£35 7 5	£6 12 7
	Parnall "Auto Dry" TD59	33½×20⅜×22⅝	6 lb	Heater: 2,500 W — 45 r.p.m.	White or cream stoved enamel. Table top in grey laminated plastic finish	Three-heat control, automatic timer and door cut-out switch, fits under draining board	£41 13 8	£7 16 4
WALLISDOWN ELECTRICAL APPLIANCES, LTD., Wallisdown Road, Bournemouth.	"Drytime"	30×21¼×19¼	6/7 lb	Heater: 2,000 W — 60 r.p.m.	White stoved enamel. Cabinet tops in white, red or blue	Three-heat switch, 90-min timer, thermal cut-out	£29 8 3	£5 4 9

Manufacturers of

HEATING SPIRALS AND FIRE ELEMENTS



★ SILICA GLASS TUBE ELEMENTS

★ MICA WOUND AND METAL CASED STRIP ELEMENTS

★ CARTRIDGE TYPE ELEMENTS

★ MINERAL EMBEDDED ELEMENTS

★ ASBESTOS WOVEN RESISTANCE MATS AND GRIDS

We invite your enquiries

ELECTRIC ELEMENTS (WILLENHALL) LTD.

Spring Lane, Willenhall
Staffs *Phone: Willenhall 870*
Telegrams: Elements, Willenhall, Staffs

WESTINGHOUSE

rectifiers with transformers



A complete range housed in ventilated sheet steel cases is available. Outputs from 50 watts to 10 kilowatts d.c. at voltages in the popular ranges 100/120, 200/250 and 400/500 volts for single- or three-phase operation are readily supplied. Write for full details and a copy of Data Sheet No. 802, to Dept. ER.1, RECTIFIER DIVISION.

WESTINGHOUSE BRAKE AND SIGNAL CO., LTD., 82 York Way, King's Cross, London, N.1

Tel: TERminus 6432



RIST'S WIRES & CABLES LTD, LOWER MILEHOUSE LANE, NEWCASTLE, STAFFS
Phone: Newcastle Staffs 51221/6

Sole London Distributors:

LYMELITE ELECTRICAL INDUSTRIES LTD, 120/4 PENTONVILLE ROAD, LONDON N.1
Phone: TERminus 9631/2

NOTICE

THIS VOLUME IS INCOMPLETE

THE FOLLOWING ISSUES ARE ON ORDER:

Vol.168 No.2-3 1961